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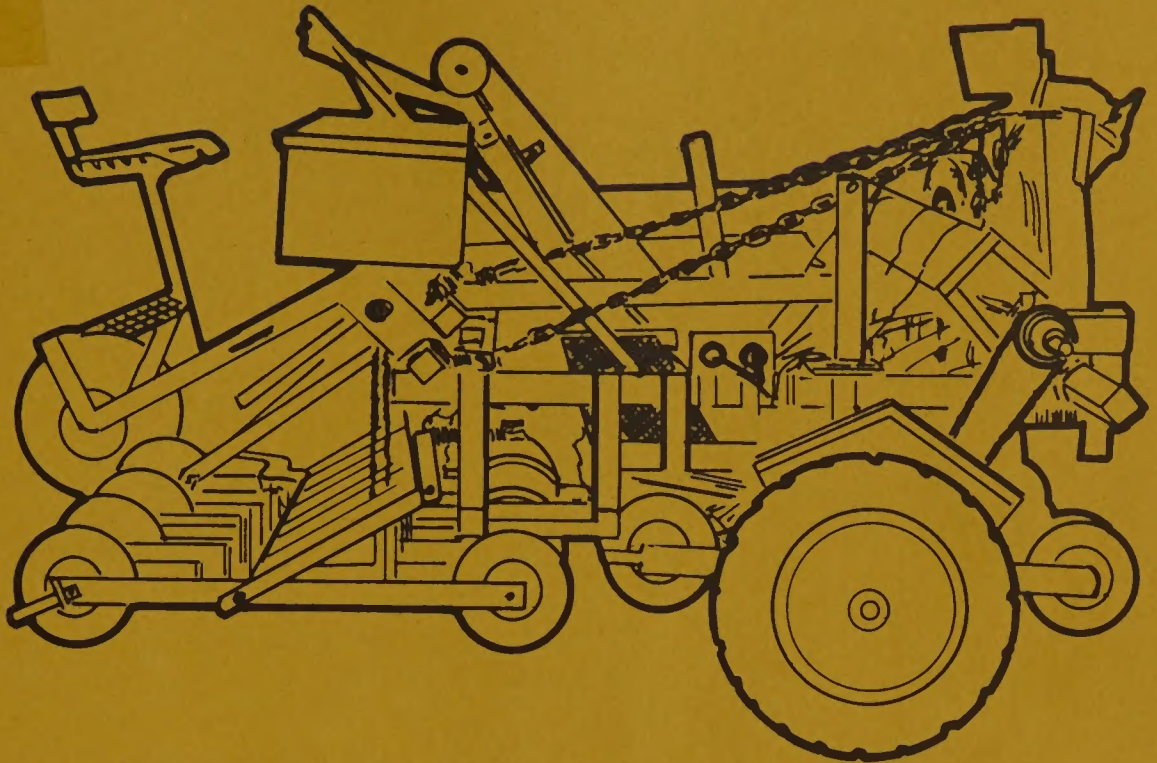
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FOREST PEST CONTROL



Evaluating
PRECISION SEEDERS
for
Tree Seedling Nurseries

ED&T 2522
PRECISION NURSERY SEEDER

SEPTEMBER 1976



USDA ■ Forest Service Equipment Development Center ■ Missoula, Montana

FOREST PEST CONTROL

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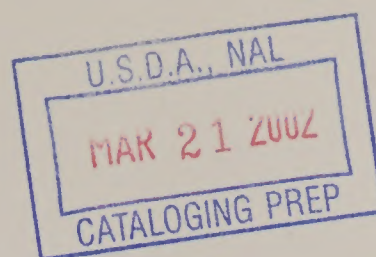
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PROJECT RECORD

EVALUATING PRECISION SEEDERS FOR TREE SEEDLING NURSERIES

ED&T 2522

PRECISION NURSERY SEEDER

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September 1976

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Missoula, Montana

ABSTRACT

Producing more tree seedlings for outplanting, with limited nursery space and more valuable seed, has made improved sowing equipment necessary. The Equipment Development Center at Missoula (MEDC) conducted a market search for available seeders, lab tested the most promising machines, and field tested one machine in cooperation with nurserymen. MEDC also monitored developments with biodegradable seed tape for tree seedling production. Additional field trials will be conducted with the Øyjord seeder; the Lotus pneumatic seeder will be tested when it is available; and future developments in seeders and tape will continue to be monitored.

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INTRODUCTION

Forest tree nurseries have shown considerable interest in improved sowing equipment. A 1974 investigation of equipment needs (Investigation of Equipment Needs in United States Nurseries, Project Record No. 7524 2212, Sept. 74) by the Missoula Equipment Development Center (MEDC) showed that of 26 problem areas identified by nurserymen, sowing was assigned number two priority. The objective of this project is to make a better seeder available to forest tree nurserymen for sowing tree seed in nursery beds.

First we analyzed operational features, and performance characteristics of seeders now being used in nurseries.

Next, we conducted a literature and market search to identify those seeders with potential for nursery use. The most promising seeders were lab tested, and those with acceptable performance were field tested.

THE PROBLEM

Based on the results of our survey and interviews with nurserymen, we learned that a seed drill must be accurate over a wide range of sowing densities with many species, and it must be easy to adjust and calibrate. A need for accurate and easily adjustable depth control was often mentioned, however, no standard was agreed on by all.

A questionnaire (appendix A) was sent to all 10 Forest Service nurseries requesting information on the major species sown, sowing densities, and sizes of average and minimum seed lots. Seven nurseries responded and from the data they supplied we determined the maximum, minimum, and average sowing rates for each species (table 1). These seeding rates were assumed representative of most U.S. nurseries.

Table 1.--Sowing data from Forest Service nurseries

Species	Number of seeds sown per linear foot of row		
	Average	Maximum	Minimum
Ponderosa pine	42	57	20
Lodgepole pine	55	167	28
Engelmann spruce	60	194	31
Douglas-fir	45	98	28
Grand fir	137	443	57
Western larch	77	127	40
Hemlock	-----no data-----		
Longleaf pine	40	47	30
Shortleaf	41	43	40
Loblolly	34	40	33
Slash	45	46	34

Although seeding rates were easily determined, we found no definite requirements for seeding accuracy in either density per square foot or spacing between seeds along the row. After considerable discussion with both nurserymen and researchers, we decided that ± 10 percent variation on density per square foot and ± 30 percent variation on spacing between seeds would be desirable. Unfortunately, the output of the seeders varied so, that a more complex statistical analysis was required and we were unable to evaluate the seeders on this simple variation.

The accuracy of seed placement by a seeder is critical, but its mechanical characteristics, such as ease of adjustment, calibration, cleaning, repeatability, seed damage, travel speeds, and variation with travel speeds, also are very important.

Nurserymen sow many small seed lots and expect to sow even more in the future. Because seed size and sowing rates often vary between seed lots, adjustment and calibration of the seeder are necessary. A seeder that is easy to adjust, calibrate, and clean would be a definite asset when seeding small lots. A single central seed hopper that feeds all rows would also be an advantage, especially if all rows start and stop seeding simultaneously.

Seed damage must be minimal. True firs are most susceptible to damage, but damage must be considered with all species. Crushing, cutting, or rubbing in the seed metering mechanism probably cause most damage.

We have talked about seed metering and distribution. The next step in the seeding process is to place the seed on or in the soil. Unfortunately there is considerable difference in the way nurserymen want to accomplish this task and a great difference in conditions at various nurseries, so standardization

was rejected. We believe the seed placement mechanism of the seeder could be modified to satisfy these varied needs.

Market Search

Information was gathered on numerous seeders by contacting the manufacturers and individuals listed in appendix B. In addition, some nurserymen stated in response to our survey of nursery practices and equipment needs that they had custom-built seeders. We evaluated the information gathered to determine which seeders might have some potential for nursery use. Some were eliminated because of slow travel speeds, incorrect row spacing, complexity, slow sowing rates, sowing inaccuracy, adjustment and calibration problems, inability to handle different seed sizes, or various other mechanical problems. Unfortunately most manufacturers did not have any experience with tree seeds, or with any seeds over the range of sowing rates required, which limited evaluation and made selection of a seeder somewhat subjective.

Because time and finances were limited, those seeders that appeared to meet the performance requirements and were suitable or could be easily adapted for nursery use were selected for initial testing, while those that were promising in principle, but needed extensive development, were not. If initial test results were negative, rejected seeders would be reexamined. A new development effort to design and build a prototype seeder was considered to be a last resort.

Most manufacturers felt that the market for a tree seedling nursery seeder was not large enough to them to justify any large development program.

Biodegradable Tape

Trials with Douglas-fir seeds in biodegradable tape furnished by Union Carbide Corp., Creative Agricultural Systems, 1328 Burton Ave., Salinas, Calif. 93901, were conducted by the Forest Service Wind River Nursery at Carson, Wash., and these trials were monitored (fig. 1). This system may offer more accurate seed placement at lower seeding rates. Seed must be sent to Union Carbide Corp. for placement in

the tape. At present, it is not possible to stratify the seed by soaking it in water before placing it in the tape, since the tape will dissolve before it can be placed in the ground. Because of these factors and present cost, it does not appear practical for all nurseries to use seed tape now; but spacing and depth control appear to be very good. Stuart Slayton, Wind River nurseryman, feels that the system has potential and that development should be monitored.

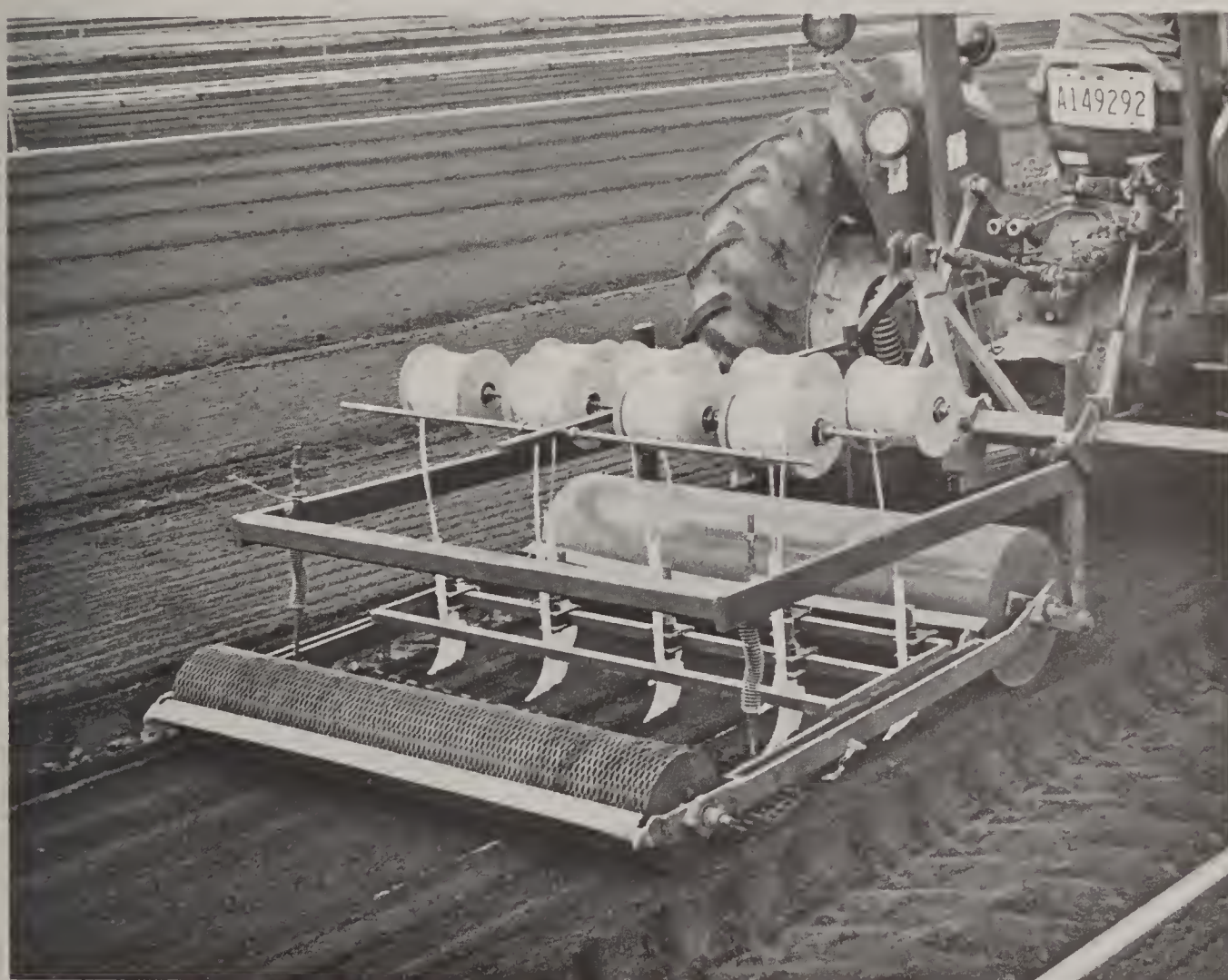


Figure 1.--Tape seeder in operation.

TEST AND EVALUATION PROCEDURE

Seeders were selected for testing using the information gathered in the market search. Seeders were evaluated for overall construction of the machine, basic metering principle, ease of adjustments, seed capacity, type and versatility of the seed placement unit, minimum row spacing, and ease of operation and cleanout.

Several species of seeds were run through each unit to determine seed damage at various settings and speeds. The maximum and minimum sowing rates and overall sowing accuracy were determined by weighing samples. If possible, these two steps were conducted with the seeder stationary, and the drive wheel blocked up or disengaged. The metering mechanism was activated to correspond to a selected length of travel over a nursery bed, and a seed sample was collected.

The next step was to determine seed distribution and accuracy by operating

the seeder as close to actual field conditions as possible. Because there is no well recognized, standard procedure for testing nursery seeders, evaluation of the data and correlation to field operation were difficult. Seeds were neither sized nor stratified so any not collected for samples could be reused. To minimize bounce and provide a permanent record, seeds were dropped on the sticky side of clear tape, transparent 3M no. 639 (fig. 2). The tape was either folded over or covered with Saran Wrap after the seeds were in place. The size and placement of the sampling tape were dictated by the configuration of the seeder. Another important factor was the necessity of keeping the amount of data collected within reason. While it would have been possible to collect data on the entire output of each seeder, this would have created a formidable data reduction task. Consequently, only enough of the output of each seeder was collected to allow a statistical evaluation (appendixes C-G).

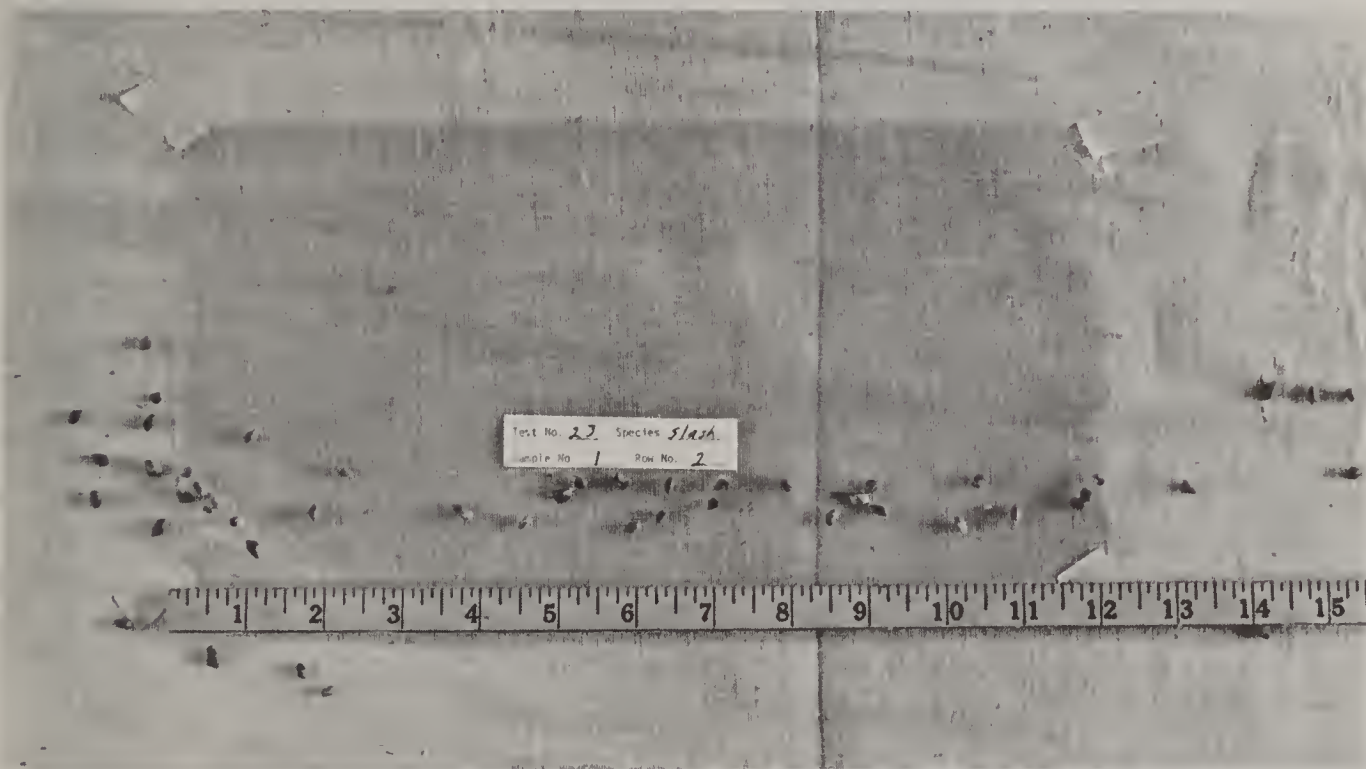


Figure 2.--Seed on sticky tape.

The number of seeds in each inch spacing, along each row sample on the tape was counted. The average number of seeds per inch and per foot was determined, as well as the variance and standard deviation of the number of seeds in each inch and each foot, and the 80 percent and 90 percent confidence interval for the average number of seeds in any inch or foot.

The variance is the mean square deviation from the mean. The standard deviation is the square root of the variance. A confidence interval is perhaps best described with an example: If the results of a test produce something that can be described with numbers and we say that the 90 percent confidence interval is 25 ± 5 , we mean that 90 times out of 100 the experiment will produce a result no smaller than 20 and no larger than 30.

The seeder that appeared most promising after laboratory testing was field tested. Two other seeders that were lab tested have been used extensively for nursery seeding, and field data were available, so further field testing was unnecessary.

SEEDER SELECTION

Pneumatic Seeder

An experimental pneumatic seeder (fig. 3) constructed at the University of Idaho, Moscow, Idaho, was lab tested in cooperation with Professor Walter L. Moden and his staff. Although this experimental model is not suitable for field use in production nurseries, it did offer the opportunity to evaluate a machine using the vacuum principle. Purchasing and operating costs were not available. The seeder can best be described by quoting from a University of Idaho report^{1/}:

In 1967 the design and construction of a pneumatic seed drum was begun. A stainless steel pipe, eight inches in diameter, was used for the drum. Six rows

(parallel to the axis of the drum) of 48 holes, one-quarter inch in diameter and at one-inch spacings were drilled at 80 degree intervals on the drum's outer surface. One-quarter inch diameter steel tubing, projecting one-half inch inside the pipe, was soldered into the holes. These projections were used to connect the orifices to internal manifolds with rubber tubing

The internal manifolds were connected to a sequencing valve, constructed of aluminum-backed graphite-impregnated Teflon discs located at each end of the seed drum The sequencing valves

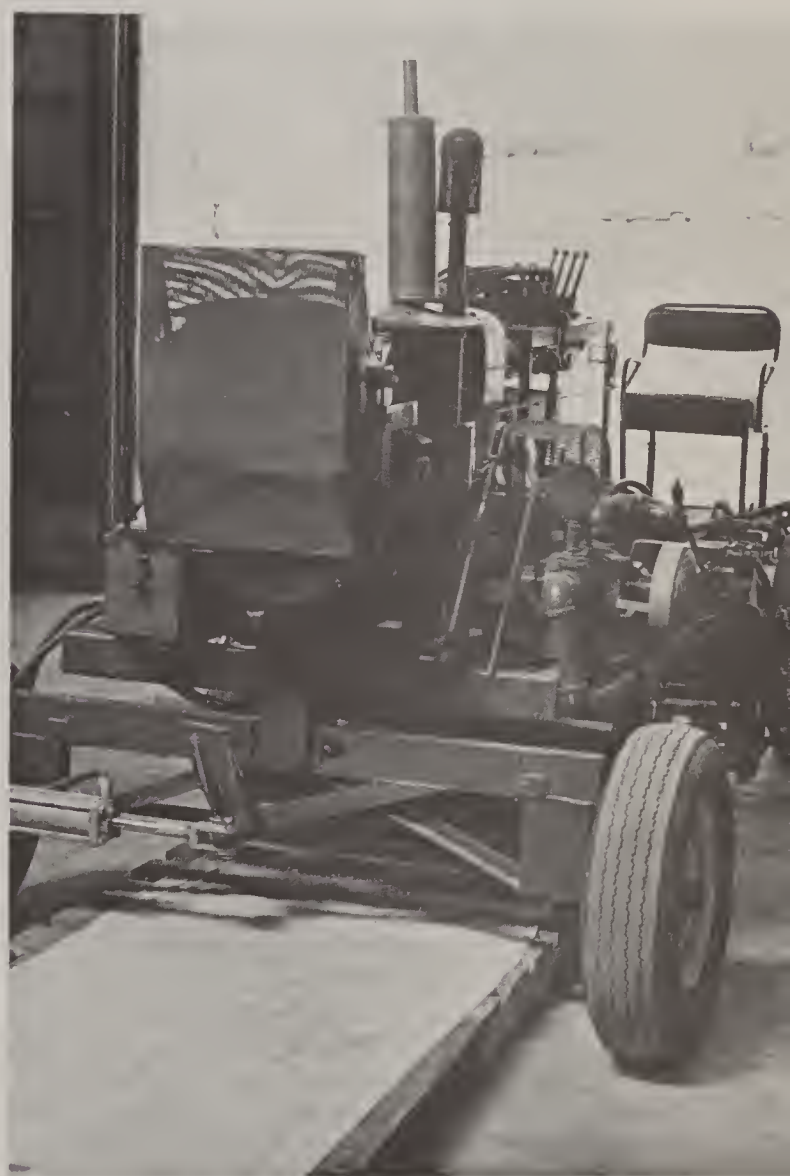


Figure 3.--Pneumatic seeder.

^{1/}

Moden, Walter L., Jr., and R.S. Jacobson. Planter for nursery seedbeds. ASAE Winter Meeting, American Society of Agricultural Engineers, Chicago, Pap. No. 73-1548. Dec. 1973.

supply vacuum to the seed orifices for 300 degrees of seed drum rotation during which time an orifice row enters the seed hopper, attaches the seeds, and carries the seeds to a position near the bottom of the drum.

The vacuum is then cut off, allowing the seeds to be released on the seedbed; 330 degrees of revolution pressure is applied to the nozzles to clean the orifices of foreign material. The seed pick-up orifices were installed on the drum surface. The optimum orifice diameter was determined from literature review and preliminary tests to be 0.029 inches.

The United States Forest Service provided a two-year matching fund grant in 1970 to further develop the seed drum and produce a field-operating unit. Construction of this field machine was started in July 1972. Three major operating components were selected for incorporation into the machine. They were a soil-compacting roller, the seed drum, and a seed pressing roller. A sand distribution device was not included as this operation could be accomplished faster and more economically by existing methods.

Hydraulic power was chosen as the field unit's main source of power. This type of power was chosen for several reasons. First, a slow ground velocity and a variable ground speed was required to match the ground speed to the seed spacing. Also, the increase or decrease of the ground velocity and changes in seed drum speed for different species and densities required the rotation of the seed drum to be variably controlled. In addition, hydraulic power was selected to raise and lower the two compacting rollers and the seed drum. Hydraulic steering was selected to simplify what would otherwise have been a complicated mechanical steering device. The unit has a 132-inch frame length and a 101-inch wheel base. The width at wheel centers is 68 inches and the height of the frame is 26 inches above ground

level. A 27 horsepower industrial gasoline engine supplies the power to a hydraulic pump that is rated at 28 gpm at 1200 rpm and 2,000 psi. This engine also powers a dry air 41 cfm vacuum pump that delivers a maximum of 22 inches of vacuum.

The control console and the operator's seat is located at the rear of the machine. The operator has complete vision of the seed drum from this position, and with minimum effort he is able to operate all hydraulic control valves. The seed hopper can be cleaned with a quick clean-out system. By switching control valves on the vacuum system, a vacuum hose can be used to remove the seed from the seed hopper. The seed is then recovered in a household vacuum cleaner bag.

All exposed rotational parts of the machine are shielded for maximum operator protection.

Limited testing of the machine by MEDC revealed little chance for seed damage. Six rows of seeds on 4-inch centers were dropped. The test area dictated that 30-foot runs were made. One-foot long sections of each row were sampled at 10, 20, and 30 feet from the starting point. Seeds not collected on the tape were dropped on cheesecloth to aid retrieval and to allow visual examination of the unsampled portion. Seed drop is very short with this machine, so bounce was not a problem.

Travel speed was limited since seeding rate was determined by the ratio of drum-rotation-speed to ground-speed; rapid drum rotation resulted in misses; and it was impossible to duplicate drum and ground speed between runs. Appendix C gives data collected and the results of the computer analysis. Testing was limited by time and funding, so it was not possible to test many combinations of vacuum and drum speed. Nor was it possible to change orifice size when testing different species.

Lotus Seeder

Limited information from the New Zealand Forest Service on the pneumatic Lotus seeder, made in New Zealand by Lotus Enterprises, was favorable. A single row prototype has been built, but we were not able to obtain a machine for testing. No other information on this machine was available. We hope to evaluate it later.

Stanhay Seeder

The Stanhay seeder (figs. 4 and 5) consists of individual units for each row mounted on a common frame. Each unit has a rubber belt with holes so the seeds fall through and are metered out onto the ground. This belt is powered by a ground-driven wheel through a gear system of chains and sprockets. The seeding rate can be adjusted by sprocket changes, belts with different hole sizes and spacing, and different plates under the belt. The machine is made in Great

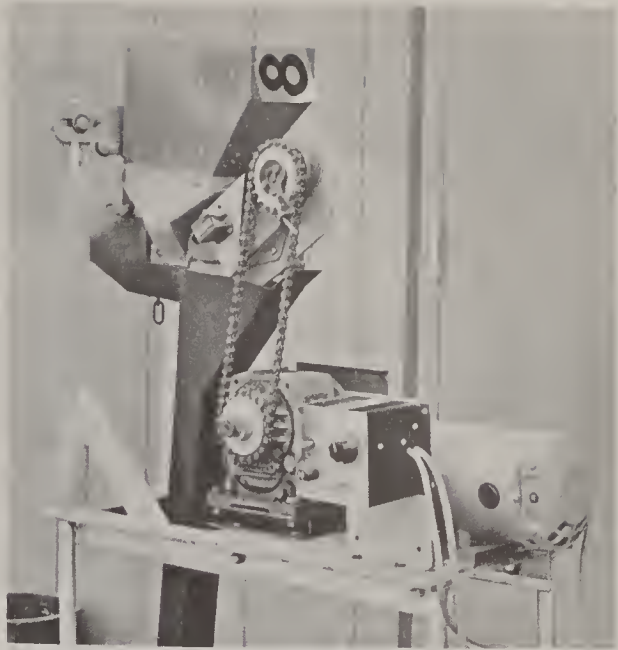


Figure 5.--Stanhay seeder test stand.



Figure 4.--Stanhay seeder.

Britain, costs \$4,000 to \$5,000 for the Mark II model tested, and according to Weyerhaeuser nurserymen, yearly maintenance is about \$800, since many of the rubber belts, drive wheels, and other parts have a shorter life. Considerable experience is required to select the proper belt/plate combination and gearing to give the desired seeding rates, and this information was not available from the distributor. Weyerhaeuser had the information for their operation, but each user would have to develop his own. Starting to test this seeder without previous experience would be a formidable task. Fortunately, Weyerhaeuser Company had used this seeder for a few years, and Gene Schmidt, Jim Bryan, and Jim Nelson of Weyerhaeuser offered to let us use their seeder and calibration standards for the tests and gave us the benefit of their experience, which helped us to select belt/plate combination and sprocket combinations.

Our testing and Weyerhaeuser experience indicates that the seeder damages true fir seed, but handles Douglas-fir, pine, and other species with little damage.

The sampling technique used with this seeder was similar to that used with the pneumatic seeder. Thirty-foot long runs were made with two row seeders operating, and 1-foot long samples in each row were taken with tape at 10, 20, and 30 feet from the starting point. The results of the computer analysis are shown in appendix D.

Gearing and belt/base selections were on the basis of test stand data previously developed by Weyerhaeuser and

their field sowing experience. Seeding rates are also affected by travel speeds; faster travel gives lower seeding rates. Field seeding rates sometimes vary greatly from test rates.

The machine is well constructed, and with the exception of the rubber parts, should not give maintenance problems. Weyerhaeuser segregates its seed into three sizes, which improves sowing accuracy somewhat. Skilled operators, who have considerable calibration data available, are needed to get the best performance from the machine. Small changes in seeding rates can be accomplished by sprocket changes, but larger changes often require different belt/plate combinations. Since one unit is required for each row, major changes are time consuming. Weyerhaeuser has two sets of units so all units can be quickly changed in the field, and the more time-consuming belt/plate changes can be done without interrupting the seeding operation. Each unit must be monitored while seeding. Since each seed hopper is separate, it is difficult to divide the seed to run out simultaneously. Cleanout of unused seed is time consuming. The seeding rates for each unit are slightly different. Each unit rides individually on leading and following press wheels. A metal shoe opens a trench, seed is dropped into the trench, and a small metal drag covers the seed with soil.

In general the machine can be made to perform satisfactorily, but it is more complicated to use than desirable and skilled operators are needed.

Wind River Seeder

The Wind River seeder is widely used, so it was tested as a reference. There is no "standard" commercially available Wind River seeder. Most nurseries have made some changes in the basic design. The particular unit tested (fig. 6) is located at the Forest Service Lucky Peak Nursery near Boise, Idaho. The nursery personnel cooperated in our lab tests.

A central hopper feeds all the metering devices (one device is required for each row). These are short cylinders, cup-shaped on both ends, with shallow flutes in the cups. When the cups rotate, the flutes meter seed out of the hopper into the drop tubes. The cups are deeper on one end of the cylinder than the other for different seed sizes. The cups are driven by a ground-driven wheel through a gearing system (fig. 7). The ratios are shown in figure 8. This information applies only to this particular seeder or one with identical gearing. Leading and

following press wheels with flanges form narrow grooves in the bed, the seed is deposited in the grooves between the wheels and pressed into the soil by the following wheel. The beds are covered with a layer of sand in a separate operation.

Testing and previous field data indicate that seed damage is minimal with this seeder.

This seeder is calibrated by blocking the unit up, turning the drive wheel one turn, and counting the seed from one row. Since the circumference of the wheel is known, the seeds per linear foot can be calculated. Because each unit feeds at a slightly different rate, an average row is selected. One row was continuously sampled on tape, and results of the computer analysis are shown in appendix E. It was soon apparent that one turn did not give reliable calibration results. Although the seeding rates over a 10-foot length were repeatable, the amount of seed deposited in any one foot could vary considerably.

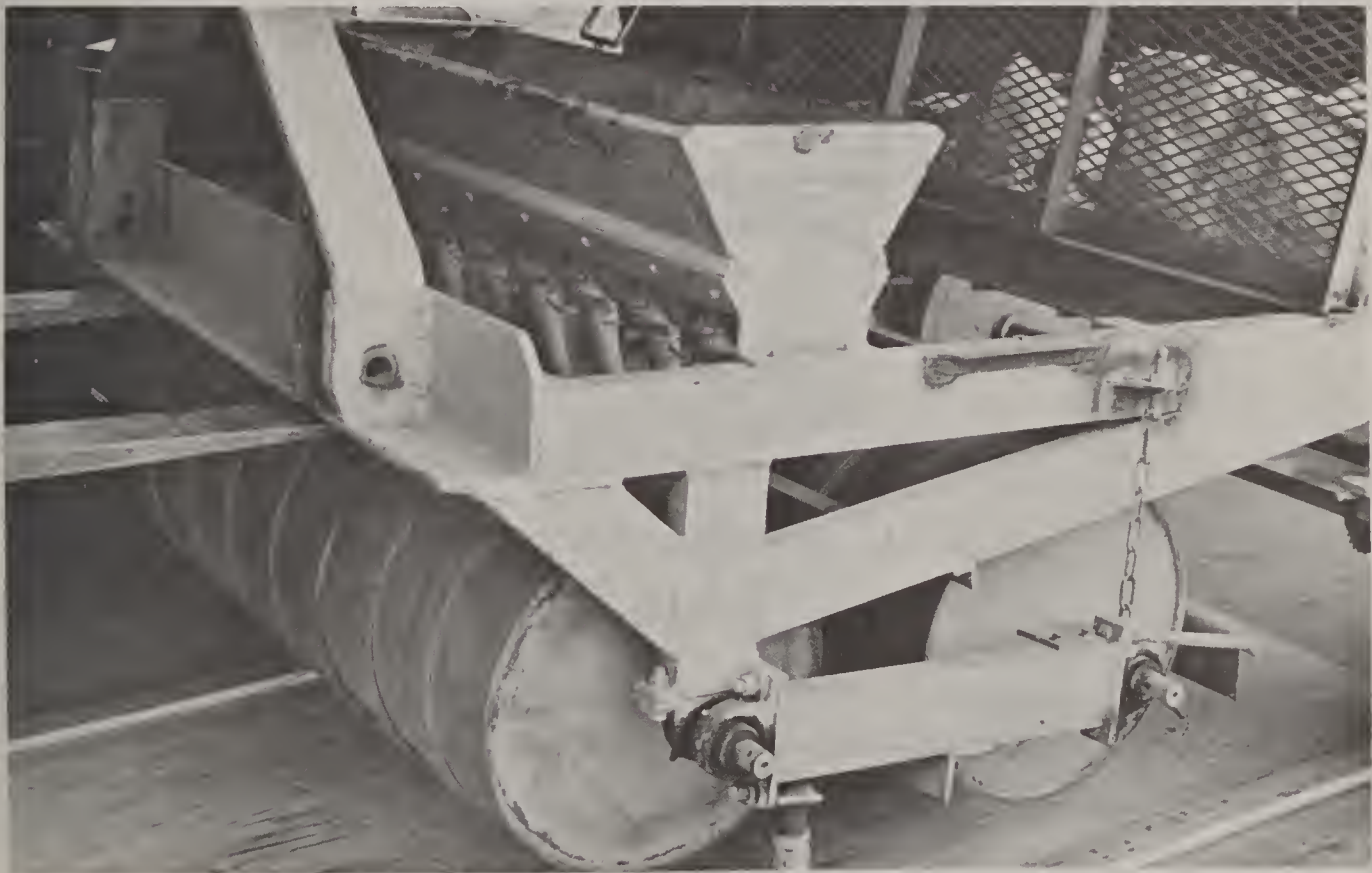


Figure 6.--Wind River seeder used in our lab tests.

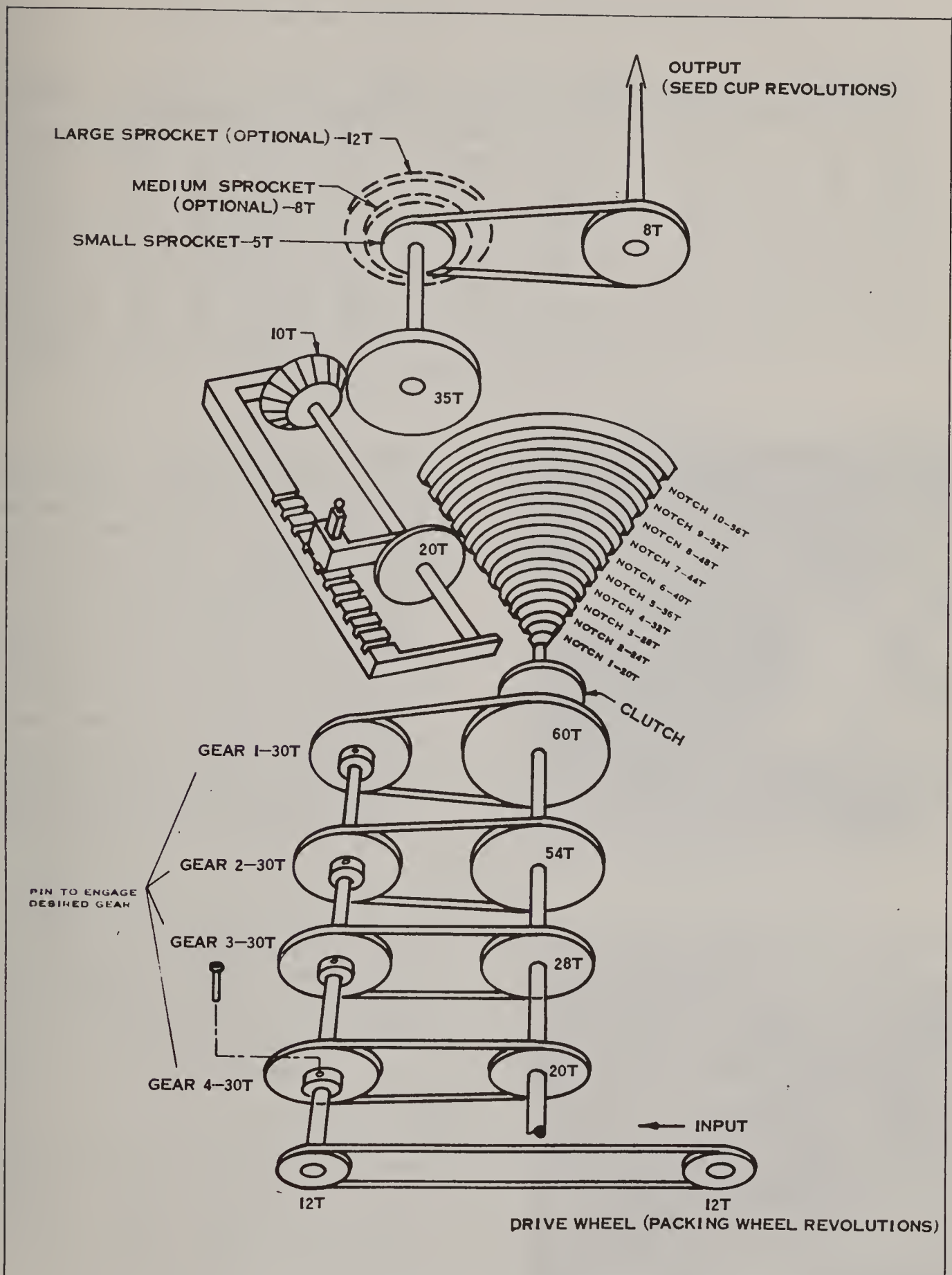


Figure 7.--Wind River seeder gearing system.

Ratios of Seed Cup Revolutions per Packing Wheel Revolution

Notch	Gear 1			Gear 2			Gear 3			Gear 4		
	Small sprocket	Medium sprocket	Large sprocket	Small sprocket	Medium sprocket	Large sprocket	Small sprocket	Medium sprocket	Large sprocket	Small sprocket	Medium sprocket	Large sprocket
1	.089	.143	.214	.098	.159	.238	.191	.306	.459	.267	.428	.642
2	.107	.171	.257	.119	.191	.286	.229	.367	.551	.321	.514	.771
3	.125	.200	.300	.139	.222	.333	.268	.429	.643	.375	.600	.900
4	.143	.229	.343	.159	.254	.381	.306	.490	.735	.429	.686	1.029
5	.161	.257	.386	.179	.286	.429	.345	.551	.827	.483	.772	1.158
6	.179	.286	.429	.199	.318	.477	.384	.613	.919	.537	.858	1.287
7	.196	.314	.471	.218	.349	.523	.420	.673	1.010	.588	.942	1.413
8	.214	.343	.514	.238	.381	.571	.459	.733	1.100	.642	1.028	1.542
9	.232	.371	.557	.258	.413	.619	.497	.796	1.194	.696	1.114	1.671
10	.250	.400	.600	.278	.444	.666	.536	.857	1.286	.750	1.200	1.800

Figure 8.--Wind River seeder ratios.

The machine is well built and maintenance free. A wide selection of gear ratios are available and changes are easy to make. The major problem appears to be calibration. Because the seeding rate varies, a large sample is required to get reliable calibration. All the metering cups are fed from a common hopper, but all rows do not run out simultaneously. This and calibration problems are especially troublesome with small seed lots. Seeding rates do not vary appreciably with travel speeds, and the central hopper simplified monitoring problems. Cleanout of unused seed is time consuming and is best accomplished with a vacuum cleaner.

Dahlman Seeder

A single row seeder manufactured by Dahlman, Inc. (figs. 9 and 10), was available for testing. Preliminary data indicated that the seeder was not sufficiently accurate for nursery use with the available belts, so no formal drop tests were conducted.

One unit is required for each row, and multiple units can be mounted on tool bars. The metering unit consists of a narrow cog belt with notches cut in the backing rubber running vertically up through a seed hopper, over the top drive sprocket, and back down over a lower idler sprocket. The seeds are picked up by the notches as they move up through the hopper, and are held in

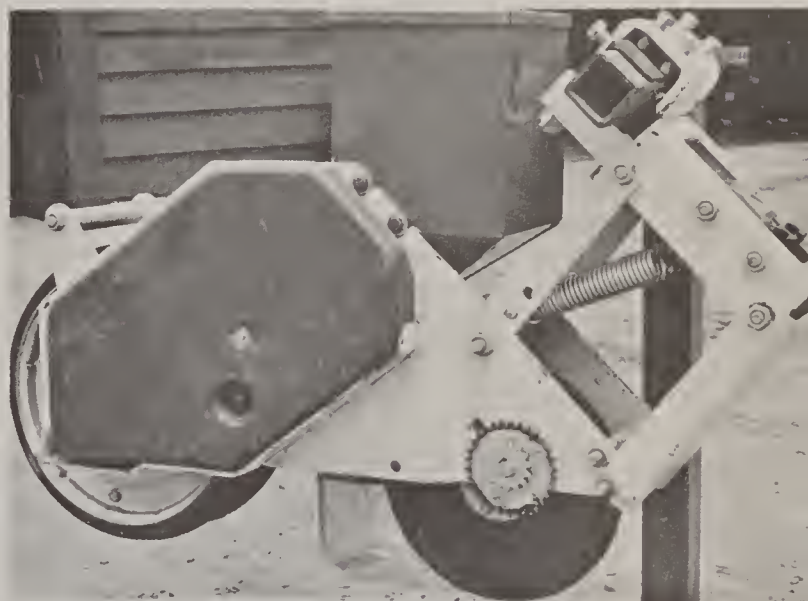


Figure 9.--Dahlman single row seeder.

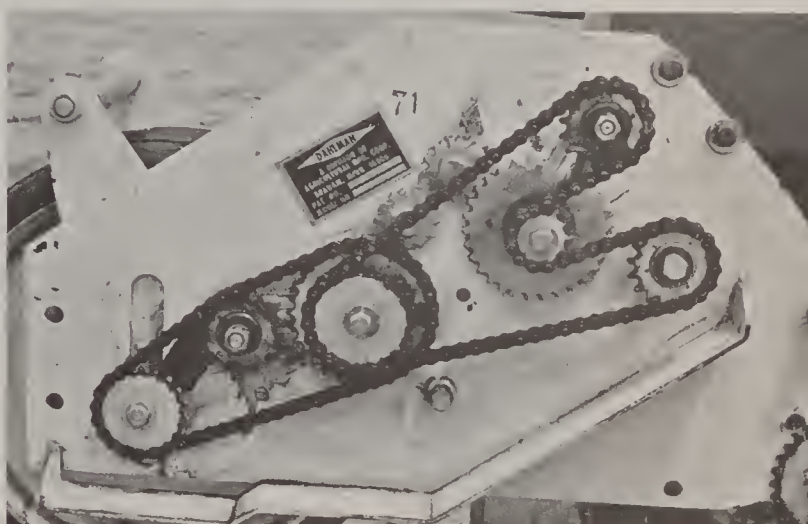


Figure 10.--Dahlman single row seeder.

place by a housing until they are at the bottom of the lower idler sprocket. The belt is ground driven by following packing wheels through a system of sprockets and chains. Five different sprockets can be used on the driven sprocket, and four different sprockets can be used on the driving sprocket for a total of 20 different gearing combinations. Different size notches can be cut in the backing rubber, but only two belts were available with the test unit. One belt had notches that appeared to be about the correct size for ponderosa pine.

Several problems were evident. With slash, lodgepole, and ponderosa pine, the available belts would not deliver enough seed even at the highest gear ratio. The driving wheel covers 40.5 inches per revolution, which gave 13 notches of belt advance. The test unit was not operated in a nursery bed, but the amount of torque required to turn the drive wheel would require considerable down pressure, which could give excessive penetration in a soft seedbed. Slippage of the drive wheel would be a source of inaccuracy. Changing

drive sprockets was cumbersome and time consuming. Mounting the individual seeding units was awkward, and it was difficult to align the drive coupling. It was also difficult to clean any excess seed from the hopper. Pitch buildup was a problem with grand fir seeds. The fact that individual seeding units are required for each row multiplies all the problems by the number of rows per bed. Excessive seed damage was evident with the species tested. There was visual evidence of crushing and cutting individual seeds. For these reasons, testing was terminated.

Ventura Seeder

The Ventura seeder, manufactured by Ventura Mfg. Implement Co., 1265 Commercial Ave., Oxnard, Calif. 93030, is a single row prototype (fig. 11) with a metering system consisting of a slow moving belt that carries a carpet of seeds out of the bottom of a trough and under a transverse-mounted, adjustable metering gate. The seeds drop on a faster moving belt and then through a

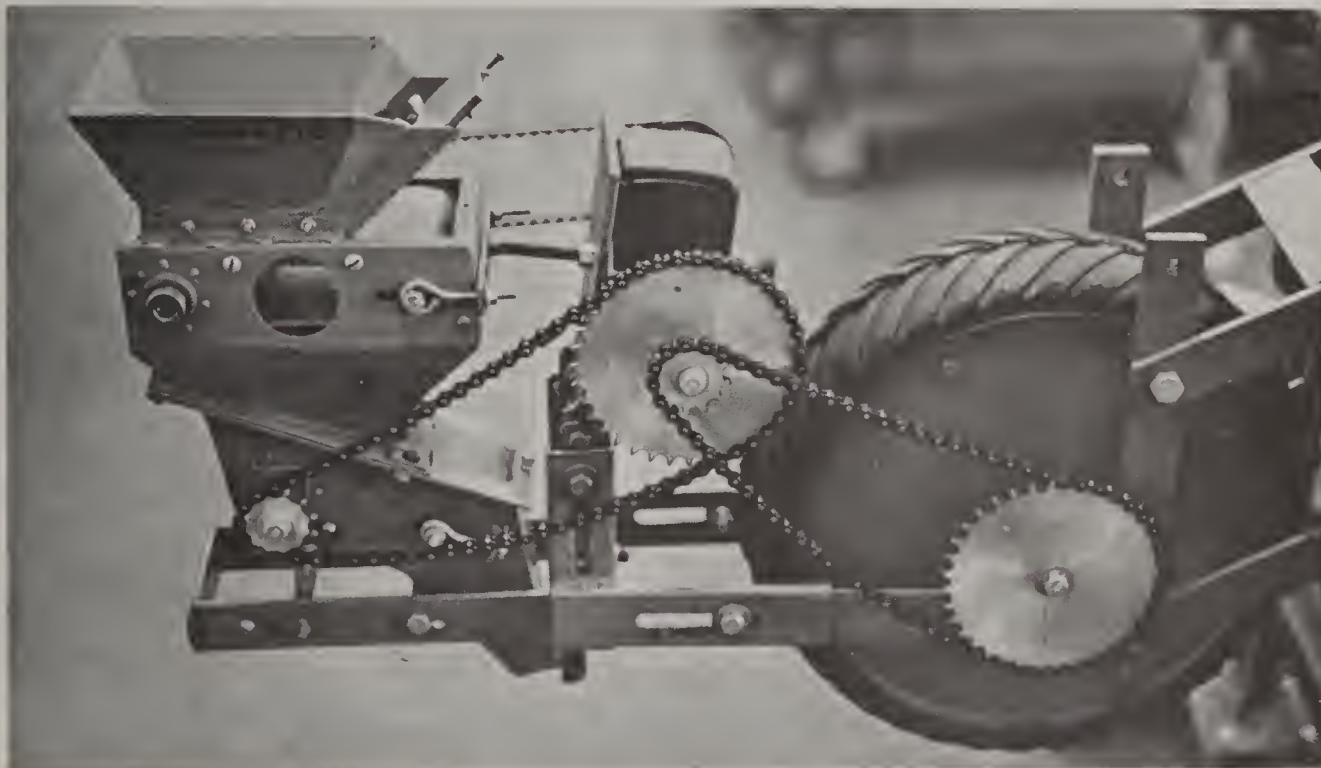


Figure 11.--Ventura seeder.

drop tube. The belts are powered by a ground wheel through an adjustable drive unit. Since the prototype was intended only to allow testing of the metering principle, it was not possible to evaluate the construction and operating characteristics of the machine. Seed damage did not appear to be a problem. MEDC lab tested only the metering system of this seeder. Cost information for a complete seeder is not available.

When initially tested, mechanical problems with the drive system prevented any evaluation of potential accuracy. The manufacturer corrected these, and we conducted additional tests. The output from the seed metering mechanism was continuously sampled on 10-foot lengths of tape, and results of the computer analysis are shown in appendix F.

Øyjord Seeder

Cargill, Inc., at Fort Collins, Colo., has used the Øyjord seeder (fig. 12), formerly manufactured in Norway, with good success. This seeder is now made

by F. Walter & H. Winterstieger KG, 4910 RIED/INNKRIS, Postfach 124, Austria. We purchased a tractor-mounted plot drill seeder with attachments for seeding six, seven, or eight rows; a large volume feeder, a fluted feeder; a small volume funnel; and a Lein funnel.

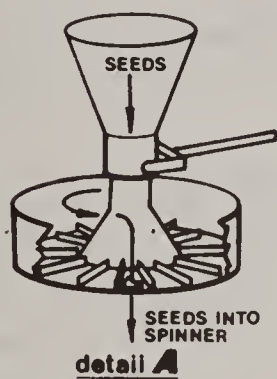
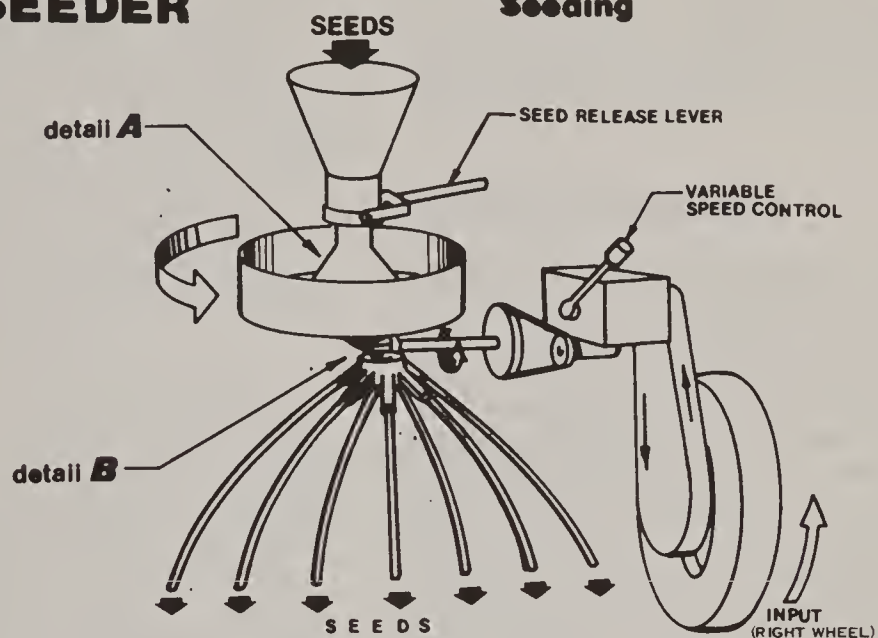
The machine is well designed and constructed, and is quite versatile. The metering principle is unique and simple. A simplified drawing of the machine is shown in figure 13. The Lein funnel or small funnel is used for seeding short plots. The ground-driven feeder is adjusted to make one revolution in any desired distance between 15 and 53 feet. The amount of seed necessary for the desired plot length is placed in the funnel, and the funnel is tripped to dump the seeds into the feeder at the beginning of the plot. The feeder then distributes the seeds along the plot through a spinner and divider head that apportions the seeds between rows as the machine moves over the ground. Calibration and adjustment are easy,



Figure 12.--Oyjord seeder.

ØYJORD SEEDER

1-Plot Seeding



2-Continuous Seeding

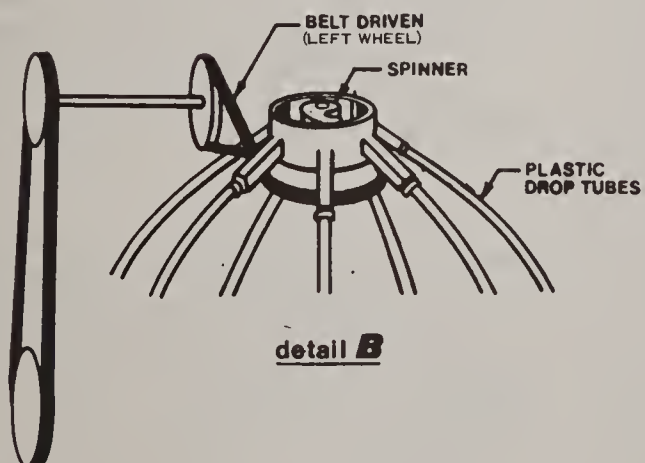
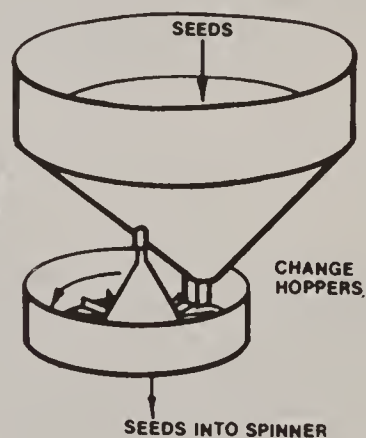


Figure 13.--Øyjord seeder, schematic.

since the seeds can be measured or weighed, and the ratio of distance traveled-per-feeder revolution is easily adjustable. For continuous seeding, the funnel is removed and a large volume hopper is installed to meter seed into the feeder. This feeding rate is adjustable, as is the ratio of feeder rotation-to-ground travel. Continuous seeding is easily calibrated by measuring or weighing the amount of seeds dispensed when the feeder is hand cranked through one revolution, and comparing this to the travel distance for one feeder revolution.

The seeder was lab tested by sampling continuous 10-foot lengths of two rows on transparent tape, and results of the computer analysis are shown in appendix G. Attachments are available for seeding 2 through 14 rows with a minimum row spacing of about 4 inches. Six-, seven-, and eight-row attachments were obtained with this machine.

Adjustment and calibration are easily and quickly done, and are reasonably precise and repeatable. Seeding rates do not vary with ground speed.

Seeds are carried from the metering mechanism to the ground by drop tubes. Two coulter, carried on a framework between the leading and following packing wheel, open a small trench for the seeds. This depth is easily adjusted by elevation screws.

The Øyjord seeder was field tested at the Forest Service Lucky Peak Nursery in November 1975. The unit seeded several small lots of ponderosa pine and several beds from a large lot. Also 77 small lots of shrubs and forbs were planted.

The machine is quite versatile, and easy to adjust and calibrate for either short or long lots. Evaluation of the machine by Frank Morby and Stephen Monsen from the Lucky Peak Nursery near Boise, Idaho, is included in appendix H. Lucky Peak Nursery will determine the stocking levels in the ponderosa pine beds using the Øyjord seeder to compare with control beds sown at the

same time with their Wind River seeder. They will keep us informed of results.

This appears to be the most promising of the seeders tested. The new manufacturer hasn't supplied purchasing costs yet, but it appears to be about \$3,500 FOB, Austria.

RESULTS AND DISCUSSION

Comparing sowing accuracy of seeders was difficult because they were tested with different species at various seeding rates. Our analysis showed that the square root of the variance (the standard deviation) of the seeding rate was proportional to the mean seeding rate. This allowed us to adjust the data in such a way that all the seeders could be compared at standard seed application rates, regardless of the rates used in the tests (tables 2 and 3). Data for each seeder has been streamlined for these tables; complete data are available in appendixes C-G. A summary of characteristics of the three operational seeders is shown in table 4. The remaining units are not considered operational and are therefore not included in the table.

CONCLUSIONS

None of the seeders tested gave the ± 10 percent variation in density per square foot desired, but this may be misleading since there is no standard method of testing or evaluation. It is doubtful that any of the seeders tested could be improved to achieve this level of accuracy. Of the seeders tested, the Øyjord is the most accurate, and the easiest to adjust and calibrate, especially for small seed lots. Mechanical and operational characteristics and accuracy potential of the unit appear to be good but additional field testing should be done to confirm this. The Lotus seeder from New Zealand may have some potential, based on information received to date. Improvements in seed tape may make that a usable tool for some applications.

Table 2.--Seeds sown per foot by seeders tested

Rate seeds sown/ft	Variance	Standard deviation	90% Confidence level		80% Confidence level	
			Seeds/ft	Seeds planted	Seeds/ft	Seeds planted
			lower limit	upper limit	lower limit	upper limit
			PNEUMATIC SEEDER			
20	24.5	5	5.4	25.4	10.6	29.4
42	51.5	7.2	21.0	63.0	28.4	55.6
57	69.9	8.4	32.5	81.5	41.2	72.8
			ØYJORD SEEDER			
20	21.4	4.6	12.1	27.9	13.9	26.1
42	44.8	6.7	30.4	53.6	33.1	50.9
57	60.9	7.8	43.5	70.5	48.1	65.9
			VENTURA SEEDER			
20	19.8	4.4	11.7	28.3	13.8	26.2
42	41.6	6.4	29.9	54.1	32.9	51.1
57	56.4	7.5	42.8	71.2	46.4	67.6
			STANHAY SEEDER			
20	23	4.8	8.7	31.3	12.1	27.9
42	48.2	6.9	25.8	58.2	30.7	53.3
57	65.4	8.1	37.9	76.1	43.7	70.3
			WIND RIVER SEEDER			
20	23	4.8	11.1	28.9	13.3	26.7
42	48.3	6.9	29.2	54.8	32.4	51.6
57	65.5	8.1	41.9	72.1	45.7	68.3

Table 3.--Seeds sown per 10 feet by seeders tested

Rate seeds sown/10 ft	Standard deviation/ 10 ft	90% Confidence level		80% Confidence level	
		Seeds/10 ft	Seeds planted	Seeds/10 ft	Seeds planted
		lower limit	upper limit	lower limit	upper limit
PNEUMATIC SEEDER					
200	5.0	153.8	246.2	170.2	229.8
420	7.2	353.5	486.5	377.1	462.9
570	8.4	492.4	647.6	519.9	620.1
ØYJORD SEEDER					
200	4.6	174.9	225.1	180.7	219.3
420	6.7	383.5	456.5	391.9	448.1
570	7.8	527.5	612.5	537.3	602.7
VENTURA SEEDER					
200	4.4	173.6	226.4	180.3	219.7
420	6.4	381.6	458.4	391.4	448.6
570	7.5	525.1	614.9	536.4	603.6
STANHAY SEEDER					
200	4.8	164.3	235.7	175.1	224.9
420	6.9	368.7	471.3	384.3	455.7
570	8.1	509.7	630.3	528	612
WIND RIVER SEEDER					
200	4.8	171.8	228.2	178.8	221.2
420	6.9	379.4	460.6	389.5	450.5
570	8.1	522.4	617.6	534.2	605.8

Table 4.--Summary of operational seeder characteristics

	<u>Øyjord</u>	<u>Stanhay</u>	<u>Wind River</u>
Ease of adjustment	Excellent	Poor	Fair
Range of adjustment	Adequate	Adequate	Adequate
Ease of calibration	Excellent	Poor	Fair
Clean-out	Excellent	Poor	Fair
Seed damage	Low	Moderate	Low
Range of travel speeds	Adequate	Limited	Adequate
Variation with speed	Low	High	Low
No. of hoppers	One	One/row	One with one pocket per row
Depth control	Good	Good	Good
Seed covering	Good	Good	Good
Construction	Good	Good	Good

RECOMMENDATIONS

1. Conduct additional field test on Øyjord seeder for field sowing accuracy and reliability and ease of operation.
2. Obtain Lotus seeder for tests.
3. Monitor developments of seed tape.
4. Continue to monitor any new developments in sowing equipment.

YOUR NAME _____

NURSERY

SOWING DENSITIES

[illegible]

COMMENTS— LIST ANY THOUGHTS YOU HAVE CONCERNING SOWING OR SOWING EQUIPMENT. IF MORE SPACE IS NEEDED, USE THE BACK OF THIS PAGE.

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- and
- Samuel G. Huber,
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Ohio Agricultural Research and Development Center
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- ASAE Paper No. 67-124
Seed Tape System For Precision Selection and Planting of
Small Vegetable Seeds
by William J. Chancellor,
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Pneumatic Seeder Test Results

TEST NUMBER	VACUUM	SPECIES	MPH
1	11 in Hg	Ponderosa Pine	.16

SEEDS PER INCH

AVERAGE	1.66111	NO. OF SEEDS	2.8744	PERCENT OF THE TIME
VARIANCE	.895686	NO. OF SEEDS	3.21995	PERCENT OF THE TIME
STD. DEV.	.946407			

ROW	1	2	3	4	5	6
AVERAGE	1.8	1.56667	1.73333	1.73333	1.63333	1.5
VARIANCE	1.61379	.874713	.685057	.685057	.722989	.87931
STD. DEV.	1.27035	.935261	.827682	.827682	.850287	.937715

SEEDS PER FOOT

AVERAGE	19.9333	NO. OF SEEDS	26.7424	PERCENT OF THE TIME
VARIANCE	2.82095	NO. OF SEEDS	28.6704	PERCENT OF THE TIME
STD. DEV.	5.31126			

TEST NUMBER	VACUUM	SPECIES	MPH
2	11 in Hg	Ponderosa Pine	.45

SEEDS PER INCH

AVERAGE	1.55556	NO. OF SEEDS	1.37334	PERCENT OF THE TIME
VARIANCE	.427064	NO. OF SEEDS	1.63057	PERCENT OF THE TIME
STD. DEV.	.653501			

ROW	1	2	3	4	5	6
AVERAGE	.666667	.466667	.5	.566667	.5	.633333
VARIANCE	.574713	.395402	.465517	.46092	.327586	.378161
STD. DEV.	.758698	.62881	.682288	.678911	.572351	.614948

SEEDS PER FOOT

AVERAGE	6.66667	NO. OF SEEDS	11.0186	PERCENT OF THE TIME
VARIANCE	11.5238	NO. OF SEEDS	12.2509	PERCENT OF THE TIME
STD. DEV.	3.39467			

TEST NUMBER	VACUUM	SPECIES	MPH
3	11 in Hg	Ponderosa Pine	.088

SEEDS PER INCH

AVERAGE	2.49444	NO. OF SEEDS	3.82562	PERCENT OF THE TIME
VARIANCE	1.07818	NO. OF SEEDS	4.20254	PERCENT OF THE TIME
STD. DEV.	1.03836			

ROW	1	2	3	4	5	6
AVERAGE	2.83333	2.03333	2.5	2.8	2.36667	2.43333
VARIANCE	.902299	1.20575	.810345	1.2	.86092	1.21954
STD. DEV.	.949894	1.09807	.900192	1.09545	.927857	1.10433

SEEDS PER FOOT

AVERAGE	29.7333	NO. OF SEEDS	36.9127	PERCENT OF THE TIME
VARIANCE	29.6381	NO. OF SEEDS	38.8887	PERCENT OF THE TIME
STD. DEV.	5.44409			

TEST NUMBER	VACUUM	SPECIES	MPH
4	7.5 in Hg	HEM lock	.13

SEEDS PER INCH

AVERAGE	6.01667	NO. OF SEEDS	10.5051	PERCENT OF THE TIME
VARIANCE	12.2623	NO. OF SEEDS	11.1111	PERCENT OF THE TIME
STD. DEV.	3.50176			

ROW	1	2	3	4	5	6
AVERAGE	8.66667	3.83333	6.53333	4.96667	5	7.1
VARIANCE	8.64368	3.59195	19.7747	6.03332	11.2	13.4379
STD. DEV.	2.94001	1.89525	4.44688	2.45624	3.31667	3.23078

SEEDS PER FOOT

AVERAGE	72.2	NO. OF SEEDS	84.5525	PERCENT OF THE TIME
VARIANCE	189.6	NO. OF SEEDS	94.8504	PERCENT OF THE TIME
STD. DEV.	13.7695			

TEST NUMBER	VACUUM	SPECIES	MPH
5	7.5 in Hg	HEM lock	.13

SEEDS PER INCH

AVERAGE	3.66667	NO. OF SEEDS	8.73886	PERCENT OF THE TIME
VARIANCE	15.6536	NO. OF SEEDS	16.1751	PERCENT OF THE TIME
STD. DEV.	3.95647			

ROW	1	2	3	4	5	6
AVERAGE	9.86667	1.96667	3.03333	3.43333	1.8	1.7
VARIANCE	12.1195	4.37816	8.1023	10.6471	2.71724	5.9655
STD. DEV.	3.48131	2.09241	2.84645	3.26172	2.17126	2.27959

SEEDS PER FOOT

AVERAGE	44	NO. OF SEEDS	66.2884	PERCENT OF THE TIME
VARIANCE	16.1429	NO. OF SEEDS	64.9005	PERCENT OF THE TIME
STD. DEV.	12.7055			

TEST NUMBER	VACUUM	SPECIES	MPH
6	7.5 in Hg	HEM lock	.12

SEEDS PER INCH

AVERAGE	3.03889	NO. OF SEEDS	6.74102	PERCENT OF THE TIME
VARIANCE	8.33926	NO. OF SEEDS	7.78928	PERCENT OF THE TIME
STD. DEV.	2.88778			

ROW	1	2	3	4	5	6
AVERAGE	2.96667	3.76667	2.3	2.36667	2.9	3.13333
VARIANCE	7.20575	12.7368	5.84483	6.37816	7.05862	10.6161
STD. DEV.	2.68435	3.56886	2.41607	2.5255	2.65441	3.25823

SEEDS PER FOOT

AVERAGE	36.4667	NO. OF SEEDS	55.2824	PERCENT OF THE TIME
VARIANCE	215.41	NO. OF SEEDS	60.6661	PERCENT OF THE TIME
STD. DEV.	14.6768			

Pneumatic Seeder Test Results

TEST NUMBER	VACUUM	SPECIES	MPH
7	8 in. Hg	Douglas Fir	.11

SEEDS PER INCH

AVERAGE	2.05	1.316048 NO. OF SEEDS	5.72325 80 PERCENT OF THE TIME
VARIANCE	4.75012	1.381085 NO. OF SEEDS	6.48109 80 PERCENT OF THE TIME
STD. DEV.	2.17927		

ROW	1	2	3	4	5	6
AVERAGE	3.7	2.8	2.7	2.45	2.7	3.95
VARIANCE	3.06316	1.61111	1.90526	4.36377	2.53684	11.7342
STD. DEV.	1.75014	1.26145	1.38031	2.08945	1.59275	3.42552

SEEDS PER FOOT

AVERAGE	36.6	1.159531 NO. OF SEEDS	57.2469 80 PERCENT OF THE TIME
VARIANCE	257.378	1.101069 NO. OF SEEDS	63.8931 80 PERCENT OF THE TIME
STD. DEV.	16.1852		

TEST NUMBER	VACUUM	SPECIES	MPH
8	8 in. Hg	Douglas Fir	.27

SEEDS PER INCH

AVERAGE	2.66556	1.376611 NO. OF SEEDS	3.8345 80 PERCENT OF THE TIME
VARIANCE	1.61449	1.084628 NO. OF SEEDS	4.09378 80 PERCENT OF THE TIME
STD. DEV.	1.27063		

ROW	1	2	3	4	5	6
AVERAGE	2.2	1.63333	1.5	1.86667	2.66667	2.76667
VARIANCE	2.16552	.86092	.741379	1.15402	1.51264	2.46092
STD. DEV.	1.47157	.927857	.861034	1.07425	1.22999	1.56873

SEEDS PER FOOT

AVERAGE	24.6667	1.187765 NO. OF SEEDS	29.2622 80 PERCENT OF THE TIME
VARIANCE	17.6667	1.172709 NO. OF SEEDS	30.8625 80 PERCENT OF THE TIME
STD. DEV.	4.13118		

TEST NUMBER	VACUUM	SPECIES	MPH
9	8 in. Hg	Douglas Fir	.45

SEEDS PER INCH

AVERAGE	1	1.157812 NO. OF SEEDS	2.15781 80 PERCENT OF THE TIME
VARIANCE	.812642	1.485648 NO. OF SEEDS	2.48565 80 PERCENT OF THE TIME
STD. DEV.	.901229		

ROW	1	2	3	4	5	6
AVERAGE	1.2	.833333	.9	.933333	.9	1.33333
VARIANCE	.993103	.551471	.644828	.557471	.644828	1.4023
STD. DEV.	.996546	.74664	.803012	.74664	.803012	1.18419

SEEDS PER FOOT

AVERAGE	12	1.821554 NO. OF SEEDS	15.3845 80 PERCENT OF THE TIME
VARIANCE	8.71429	1.714377 NO. OF SEEDS	16.256 80 PERCENT OF THE TIME
STD. DEV.	2.952		

TEST NUMBER	VACUUM	SPECIES	MPH
10	11 in. Hg	Slash Pine	.11

SEEDS PER INCH

AVERAGE	2.58333	1.9379 NO. OF SEEDS	4.20972 80 PERCENT OF THE TIME
VARIANCE	1.60754	1.477656 NO. OF SEEDS	4.66701 80 PERCENT OF THE TIME
STD. DEV.	1.26787		

ROW	1	2	3	4	5	6
AVERAGE	2.7	2.9	2.5	2.06667	2.3	2.33333
VARIANCE	1.11319	1.54138	1.5	1.04885	1.04118	1.1847
STD. DEV.	1.05536	1.24152	1.22474	1.02412	1.02041	1.07167

SEEDS PER FOOT

AVERAGE	31	1.248517 NO. OF SEEDS	37.1483 80 PERCENT OF THE TIME
VARIANCE	23	1.031109 NO. OF SEEDS	39.8211 80 PERCENT OF THE TIME
STD. DEV.	4.79593		

TEST NUMBER	VACUUM	SPECIES	MPH
11	18 in. Hg	Slash Pine	.35

SEEDS PER INCH

AVERAGE	.244444	1.102514 NO. OF SEEDS	1.7412 80 PERCENT OF THE TIME
VARIANCE	.5455	1.370519 NO. OF SEEDS	2.05441 80 PERCENT OF THE TIME
STD. DEV.	.73858		

ROW	1	2	3	4	5	6
AVERAGE	.7	.8	.8	.9	.9	.96667
VARIANCE	.286207	.372414	.441319	.366706	.75251	1.06232
STD. DEV.	.534983	.610257	.664324	.607405	.867336	1.03035

SEEDS PER FOOT

AVERAGE	10.1333	1.498553 NO. OF SEEDS	5.2211 80 PERCENT OF THE TIME
VARIANCE	16.1232	1.352792 NO. OF SEEDS	16.1387 80 PERCENT OF THE TIME
STD. DEV.	4.01545		

TEST NUMBER	VACUUM	SPECIES	MPH
12	4 in. Hg	Engelmann Spruce	.11

SEEDS PER INCH

AVERAGE	2.7	1.252161 NO. OF SEEDS	12.8714 80 PERCENT OF THE TIME
VARIANCE	16.2782	1.06364 NO. OF SEEDS	14.334 80 PERCENT OF THE TIME
STD. DEV.	4.03463		

ROW	1	2	3	4	5	6
AVERAGE	8.46667	6.8	7.13333	7.23333	6.93333	7.43333
VARIANCE	13.4644	22.2445	10.7402	9.56437	12.2447	17.2175
STD. DEV.	4.29402	4.71555	3.27723	3.09262	3.45715	4.38401

SEEDS PER FOOT

AVERAGE	92.4	1.785856 NO. OF SEEDS	106.2014 80 PERCENT OF THE TIME
VARIANCE	116.114	1.746741 NO. OF SEEDS	110.106 80 PERCENT OF THE TIME
STD. DEV.	10.7756		

Pneumatic Seeder Test Results

TEST NUMBER	VACUUM	SPECIES	MPH
13	4-5 in. Hg	Engelmann Spruce	.51

SEEDS PER INCH

AVERAGE	1.78333	1.79755 NO. OF SEEDS	5.36421 NO PERCENT OF THE TIME
VARIANCE	7.80196	2.81148 NO. OF SEEDS	6.37814 NO PERCENT OF THE TIME
STD. DEV.	2.79333		

ROW	1	2	3	4	5	6
AVERAGE	2.6	1.26667	1.8	1.63333	1.9	1.5
VARIANCE	11.4207	5.09985	8.30345	5.96417	9.40345	6.87931
STD. DEV.	3.37945	2.25806	2.88157	2.44221	3.0665	2.62284

SEEDS PER FOOT

AVERAGE	2.14	1.63533 NO. OF SEEDS	4.11647 NO PERCENT OF THE TIME
VARIANCE	337.686	3.96106 NO. OF SEEDS	4.67611 NO PERCENT OF THE TIME
STD. DEV.	15.4171		

TEST NUMBER	VACUUM	SPECIES	MPH
14	4-5 in. Hg	SHORT LEAF Pine	.13

SEEDS PER INCH

AVERAGE	2.73333	1.902171 NO. OF SEEDS	4.5645 NO PERCENT OF THE TIME
VARIANCE	2.04022	3.83675 NO. OF SEEDS	5.08299 NO PERCENT OF THE TIME
STD. DEV.	1.42836		

ROW	1	2	3	4	5	6
AVERAGE	2.7	2.83333	2.8	2.93333	2.4	2.73333
VARIANCE	1.80345	1.79885	2.9931	1.78851	1.90345	2.13333
STD. DEV.	1.34293	1.34121	1.73006	1.33735	1.37966	1.46059

SEEDS PER FOOT

AVERAGE	32.8	125.2125 NO. OF SEEDS	40.3875 NO PERCENT OF THE TIME
VARIANCE	35.0286	123.0641 NO. OF SEEDS	42.5359 NO PERCENT OF THE TIME
STD. DEV.	5.91847		

TEST NUMBER	VACUUM	SPECIES	MPH
15	4-5 in. Hg	SHORT LEAF Pine	.40

SEEDS PER INCH

AVERAGE	1.99444	1.45576 NO. OF SEEDS	2.44446 NO PERCENT OF THE TIME
VARIANCE	1.2793	1.866151 NO. OF SEEDS	2.85504 NO PERCENT OF THE TIME
STD. DEV.	1.13106		

ROW	1	2	3	4	5	6
AVERAGE	1.03333	.766667	1.3	1.1	.8	.966667
VARIANCE	.791954	.805747	2.14828	1.61034	.993103	1.34368
STD. DEV.	.889918	.897634	1.4657	1.26899	.996546	1.15917

SEEDS PER FOOT

AVERAGE	11.9333	17.02843 NO. OF SEEDS	16.8382 NO PERCENT OF THE TIME
VARIANCE	14.6381	15.6396 NO. OF SEEDS	18.2271 NO PERCENT OF THE TIME
STD. DEV.	3.82598		

TEST NUMBER	VACUUM	SPECIES	MPH
16	4-5 in. Hg	LPP Lodge Pole Pine	.25

SEEDS PER INCH

AVERAGE	4.38333	1.59207 NO. OF SEEDS	7.17459 NO PERCENT OF THE TIME
VARIANCE	4.7405	1.801725 NO. OF SEEDS	7.96494 NO PERCENT OF THE TIME
STD. DEV.	2.17727		

ROW	1	2	3	4	5	6
AVERAGE	4.53333	3.86667	3.76667	4.66667	4.86667	4.5
VARIANCE	3.98161	3.84168	3.77126	1.71264	5.27471	1.52418
STD. DEV.	1.9954	1.96053	1.9447	2.59385	2.2966	2.12513

SEEDS PER FOOT

AVERAGE	52.6	140.0783 NO. OF SEEDS	65.1217 NO PERCENT OF THE TIME
VARIANCE	95.4	136.5328 NO. OF SEEDS	68.4672 NO PERCENT OF THE TIME
STD. DEV.	9.76729		

TEST NUMBER	VACUUM	SPECIES	MPH
17	4-5 in. Hg	LPP Lodge Pole Pine	.25

SEEDS PER INCH

AVERAGE	1.75	1.127093 NO. OF SEEDS	3.62709 NO PERCENT OF THE TIME
VARIANCE	2.14385	1.658594 NO. OF SEEDS	4.15859 NO PERCENT OF THE TIME
STD. DEV.	1.46419		

ROW	1	2	3	4	5	6
AVERAGE	2.2	1.63333	1.5	1.76667	1.66667	1.73333
VARIANCE	3.06207	1.82644	1.2931	3.21954	1.74713	1.78851
STD. DEV.	1.74988	1.35146	1.13715	1.79431	1.32179	1.33735

SEEDS PER FOOT

AVERAGE	21	113.6355 NO. OF SEEDS	28.3645 NO PERCENT OF THE TIME
VARIANCE	33	111.5502 NO. OF SEEDS	30.4498 NO PERCENT OF THE TIME
STD. DEV.	5.74456		

TEST NUMBER	VACUUM	SPECIES	MPH
18	5 in. Hg	Grand Fir	.12

SEEDS PER INCH

AVERAGE	1.24444	1.233795 NO. OF SEEDS	2.25509 NO PERCENT OF THE TIME
VARIANCE	1.621477	1.0523721 NO. OF SEEDS	2.5426 NO PERCENT OF THE TIME
STD. DEV.	1.27338		

ROW	1	2	3	4	5	6
AVERAGE	1.13333	1.26667	1.26667	1.23333	1.16667	1.4
VARIANCE	.74023	.478161	.547126	.598851	.695402	.731034
STD. DEV.	.860366	.691492	.73968	.773854	.833908	.855006

SEEDS PER FOOT

AVERAGE	14.9333	110.9239 NO. OF SEEDS	18.9427 NO PERCENT OF THE TIME
VARIANCE	9.78095	9.78868 NO. OF SEEDS	20.028 NO PERCENT OF THE TIME
STD. DEV.	3.12745		

Pneumatic Seeder Test Results

TEST NUMBER 19	VACUUM 5 in. Hg	SPECIES GF Grand Fir	MPH 1.5
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SEEDS PER INCH

AVERAGE .483333
VARIANCE .351676
STD. DEV. .593023

1.276922 NO. OF SEEDS 1.24359 90 PERCENT OF THE TIME
1.492189 NO. OF SEEDS 1.45886 90 PERCENT OF THE TIME

ROW	1	2	3	4	5	6
AVERAGE	.5	.533333	.466667	.533333	.366667	.5
VARIANCE	.396552	.395402	.257471	.395402	.309195	.396552
STD. DEV.	.629724	.62881	.507416	.62881	.556053	.629724

SEEDS PER FOOT

AVERAGE 5.8
VARIANCE 3.17143
STD. DEV. 1.78085

13.51695 NO. OF SEEDS 18.08305 90 PERCENT OF THE TIME
12.8705 NO. OF SEEDS 18.7295 90 PERCENT OF THE TIME

TEST NUMBER 20	VACUUM 16 in. Hg	SPECIES LL Longleaf Pine	MPH 1.4
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SEEDS PER INCH

AVERAGE 1.16111
VARIANCE .605183
STD. DEV. .777935

1.163798 NO. OF SEEDS 12.15842 90 PERCENT OF THE TIME
1.118592 NO. OF SEEDS 12.44081 90 PERCENT OF THE TIME

ROW	1	2	3	4	5	6
AVERAGE	1.46667	1.16667	1.23333	1.06667	.966667	1.06667
VARIANCE	.671264	.488506	.598851	.891954	.516092	.409195
STD. DEV.	.819307	.698932	.773854	.944433	.718395	.639684

SEEDS PER FOOT

AVERAGE 13.9333
VARIANCE 3.49524
STD. DEV. 1.86956

11.5266 NO. OF SEEDS 16.3301 90 PERCENT OF THE TIME
10.8579 NO. OF SEEDS 17.0088 90 PERCENT OF THE TIME

TEST NUMBER 21	VACUUM 16 in. Hg	SPECIES LL Longleaf	MPH 1.7
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SEEDS PER INCH

AVERAGE 1.394444
VARIANCE .329578
STD. DEV. .574089

1.341537 NO. OF SEEDS 1.13043 90 PERCENT OF THE TIME
1.549932 NO. OF SEEDS 1.33882 90 PERCENT OF THE TIME

ROW	1	2	3	4	5	6
AVERAGE	.466667	.466667	.4	.333333	.333333	.366667
VARIANCE	.326437	.464368	.386207	.298851	.298851	.24023
STD. DEV.	.571346	.681445	.621455	.546672	.546672	.490133

SEEDS PER FOOT

AVERAGE 4.73333
VARIANCE 4.06667
STD. DEV. 2.0166

12.14805 NO. OF SEEDS 17.31861 90 PERCENT OF THE TIME
1.41603 NO. OF SEEDS 18.05064 90 PERCENT OF THE TIME

Stanhay Seeder Test Results

TEST NUMBER 22	SETTINGS- 26 PUNCH 48 HOLE PZ GEARING	Y BASE P CHOKE	SPECIES Slash Pine	MPH 128
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SEEDS PER INCH

AVERAGE 4.02778	1.8338 L NO. OF SEEDS L 6.22126 80 PERCENT OF THE TIME
VARIANCE 2.92879	1.21257 L NO. OF SEEDS L 6.84299 90 PERCENT OF THE TIME
STD. DEV. 1.71137	Max = 8 Min = 1

SEEDS PER FOOT

AVERAGE 46.2333	36.2889 L NO. OF SEEDS L 60.778 80 PERCENT OF THE TIME
VARIANCE 88.2667	32.8765 L NO. OF SEEDS L 83.7882 90 PERCENT OF THE TIME
STD. DEV. 9.39503	1ST FT 42 SEEDS 3RD FT 53 SEEDS 5TH FT 52
	2ND FT 43 SEEDS 4TH FT 51 SEEDS 6TH FT 49

TEST NUMBER 23	SETTINGS- 26 PUNCH 48 HOLE PZ GEARING	Y BASE P CHOKE	SPECIES Slash Pine	MPH 136
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SEEDS PER INCH

AVERAGE 2.91667	.992189 L NO. OF SEEDS L 4.84121 80 PERCENT OF THE TIME
VARIANCE 2.55362	.447181 L NO. OF SEEDS L 5.3865 90 PERCENT OF THE TIME
STD. DEV. 1.59121	Max = 6 Min = 0

SEEDS PER FOOT

AVERAGE —	— L NO. OF SEEDS L — 80 PERCENT OF THE TIME
VARIANCE —	— L NO. OF SEEDS L — 90 PERCENT OF THE TIME
STD. DEV. —	1ST FT 39 SEEDS 3RD FT — SEEDS 5TH FT —
	2ND FT 31 SEEDS 4TH FT — SEEDS 6TH FT —

TEST NUMBER 24	SETTINGS- 19 PUNCH 56 HOLE PZ GEARING	Z BASE P CHOKE	SPECIES Engelmann Spruce	MPH 76
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SEEDS PER INCH

AVERAGE 10.2778	.4854 L NO. OF SEEDS L 20.07 80 PERCENT OF THE TIME
VARIANCE 58.5493	-2.227 L NO. OF SEEDS L 22.84 90 PERCENT OF THE TIME
STD. DEV. 7.63834	Max = 27 Min = 0

SEEDS PER FOOT

AVERAGE 123.333	101.871 L NO. OF SEEDS L 144.796 80 PERCENT OF THE TIME
VARIANCE 280.267	75.794 L NO. OF SEEDS L 150.872 90 PERCENT OF THE TIME
STD. DEV. 16.7412	1ST FT 120 SEEDS 3RD FT 138 SEEDS 5TH FT 140
	2ND FT 105 SEEDS 4TH FT 129 SEEDS 6TH FT 108

TEST NUMBER 25	SETTINGS- 19 PUNCH 56 HOLE PZ GEARING	Z BASE P CHOKE	SPECIES Engelmann Spruce	MPH 95
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SEEDS PER INCH

AVERAGE 17.3194	9.74931 L NO. OF SEEDS L 23.8896 80 PERCENT OF THE TIME
VARIANCE 34.8683	7.60589 L NO. OF SEEDS L 22.0321 90 PERCENT OF THE TIME
STD. DEV. 5.90494	Max = 30 Min = 6

SEEDS PER FOOT

AVERAGE 207.833	188.032 L NO. OF SEEDS L 272.635 80 PERCENT OF THE TIME
VARIANCE 238.567	182.425 L NO. OF SEEDS L 233.391 90 PERCENT OF THE TIME
STD. DEV. 15.4456	1ST FT 209 SEEDS 3RD FT 222 SEEDS 5TH FT 235
	2ND FT 201 SEEDS 4TH FT 183 SEEDS 6TH FT 197

TEST NUMBER 26	SETTINGS- 20 PUNCH 45 HOLE PZ GEARING	B BASE P CHOKE	SPECIES White Pine	MPH —
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SEEDS PER INCH

AVERAGE 9.79167	4.31443 L NO. OF SEEDS L 15.2688 80 PERCENT OF THE TIME
VARIANCE 18.2535	2.76354 L NO. OF SEEDS L 16.0198 90 PERCENT OF THE TIME
STD. DEV. 4.27242	Max = 20 Min = 2

SEEDS PER FOOT

AVERAGE 117.5	97.8479 L NO. OF SEEDS L 137.153 80 PERCENT OF THE TIME
VARIANCE 235	92.286 L NO. OF SEEDS L 142.717 90 PERCENT OF THE TIME
STD. DEV. 15.3297	1ST FT 123 SEEDS 3RD FT 117 SEEDS 5TH FT —
	2ND FT 114 SEEDS 4TH FT 118 SEEDS 6TH FT —

TEST NUMBER 27	SETTINGS- 20 PUNCH 45 HOLE PZ GEARING	B BASE P CHOKE	SPECIES White Pine	MPH 120
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SEEDS PER INCH

AVERAGE 10.8611	5.88754 L NO. OF SEEDS L 13.8276 80 PERCENT OF THE TIME
VARIANCE 15.0509	4.47926 L NO. OF SEEDS L 12.293 90 PERCENT OF THE TIME
STD. DEV. 3.87954	Max = 21 Min = 2

SEEDS PER FOOT

AVERAGE 130.333	120.649 L NO. OF SEEDS L 148.016 80 PERCENT OF THE TIME
VARIANCE 57.0667	117.807 L NO. OF SEEDS L 142.76 90 PERCENT OF THE TIME
STD. DEV. 7.55425	1ST FT 120 SEEDS 3RD FT 128 SEEDS 5TH FT 133
	2ND FT 139 SEEDS 4TH FT 121 SEEDS 6TH FT 141

TEST NUMBER 28	SETTINGS- 20 PUNCH 45 HOLE PZ GEARING	B BASE P CHOKE	SPECIES White Pine	MPH 114
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SEEDS PER INCH

AVERAGE 5.722	1.00217 L NO. OF SEEDS L 10.7423 80 PERCENT OF THE TIME
VARIANCE 13.556	-3.34317 L NO. OF SEEDS L 11.7788 90 PERCENT OF THE TIME
STD. DEV. 3.682	Max = 16 Min = 0

SEEDS PER FOOT

AVERAGE 68.6667	57.423 L NO. OF SEEDS L 78.921 80 PERCENT OF THE TIME
VARIANCE 77.0667	54.2286 L NO. OF SEEDS L 83.107 90 PERCENT OF THE TIME
STD. DEV. 8.77876	1ST FT 66 SEEDS 3RD FT 64 SEEDS 5TH FT 57
	2ND FT 68 SEEDS 4TH FT 64 SEEDS 6TH FT 67

TEST NUMBER 29 A	SETTINGS- 20 PUNCH 60 HOLE PZ GEARING	D BASE P CHOKE	SPECIES White Pine	MPH 102
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SEEDS PER INCH

AVERAGE 6.75	3.53869 L NO. OF SEEDS L 9.86121 80 PERCENT OF THE TIME
VARIANCE 6.27465	2.6293 L NO. OF SEEDS L 10.8706 90 PERCENT OF THE TIME
STD. DEV. 2.50492	Max = 13 Min = 1

SEEDS PER FOOT

AVERAGE 81	69.0286 L NO. OF SEEDS L 92.9714 80 PERCENT OF THE TIME
VARIANCE 87.2	65.6388 L NO. OF SEEDS L 96.3602 90 PERCENT OF THE TIME
STD. DEV. 9.33809	1ST FT 80 SEEDS 3RD FT 67 SEEDS 5TH FT 85
	2ND FT 91 SEEDS 4TH FT 72 SEEDS 6TH FT 92

Stanhay Seeder Test Results

TEST NUMBER	SETTINGS -	PUNCH	BASE	SPECIES	MPH
29 B		<u>20</u>	<u>P</u>	Shortleaf	1.26
		<u>60</u>	<u>P</u>		
		<u>PY</u>	GEARING		

SEEDS PER INCH

AVERAGE
5.83333
VARIANCE
7.29577
STD. DEV.
2.70107

Max - 15 Min 2

2.37056 NO. OF SEEDS 9.2961 90 PERCENT OF THE TIME

1.39007 NO. OF SEEDS 10.2766 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE
70
VARIANCE
84.4
STD. DEV.
9.18695

58.22231 NO. OF SEEDS 81.7777 90 PERCENT OF THE TIME

54.8875 NO. OF SEEDS 85.1125 90 PERCENT OF THE TIME

1ST FT 72 SEEDS 3RD FT 56 SEEDS 5TH FT 74

2ND FT 71 SEEDS 4TH FT 70 SEEDS 6TH FT 77

Wind River Seeder Test Results

TEST NUMBER 46	SETTINGS - <u>Small</u> SPROCKET <u>3</u> GEAR <u>Small</u> CUP <u>2</u> NOTCH	SPECIES Western Larch	MPH
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SEEDS PER INCH

AVERAGE 6.5	MAXIMUM 15	MINIMUM 1	VARIANCE 6.49748	STD. DEV. 2.54902
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3.0316 LND. OF SEEDS 1.5674 50 PERCENT OF THE TIME

5.1065 LND. OF SEEDS 1.0495 50 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 75.6	MAXIMUM 92	MINIMUM 67	VARIANCE 110.489	STD. DEV. 10.5114
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1ST FT 92 SEEDS 3RD FT 75 SEEDS 5TH FT 81 SEEDS 7TH FT 73 SEEDS

2ND FT 61 SEEDS 4TH FT 75 SEEDS 6TH FT 74 SEEDS 8TH FT 72 SEEDS

62.1244 LND. OF SEEDS 88.0278 50 PERCENT OF THE TIME

58.3088 LND. OF SEEDS 72.8912 50 PERCENT OF THE TIME

TEST NUMBER 47	SETTINGS - <u>Small</u> SPROCKET <u>3</u> GEAR <u>Small</u> CUP <u>2</u> NOTCH	SPECIES Western Larch	MPH
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SEEDS PER INCH

AVERAGE 6.2	MAXIMUM 16	MINIMUM 2	VARIANCE 6.56471	STD. DEV. 2.56217
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2.9153 LND. OF SEEDS 9.7447 50 PERCENT OF THE TIME

1.9523 LND. OF SEEDS 10.4476 50 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 74.4	MAXIMUM 96	MINIMUM 66	VARIANCE 39.6	STD. DEV. 6.29285
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1ST FT 72 SEEDS 3RD FT 70 SEEDS 5TH FT 68 SEEDS 7TH FT 68 SEEDS

2ND FT 72 SEEDS 4TH FT 96 SEEDS 6TH FT 91 SEEDS 8TH FT 67 SEEDS

66.3326 LND. OF SEEDS 82.7674 50 PERCENT OF THE TIME

64.0483 LND. OF SEEDS 84.2517 50 PERCENT OF THE TIME

TEST NUMBER 48	SETTINGS - <u>Small</u> SPROCKET <u>3</u> GEAR <u>Small</u> CUP <u>2</u> NOTCH	SPECIES Western Larch	MPH
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SEEDS PER INCH

AVERAGE 5.70833	MAXIMUM 14	MINIMUM 1	VARIANCE 5.368	STD. DEV. 2.31689
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2.73808 LND. OF SEEDS 8.67859 50 PERCENT OF THE TIME

1.89704 LND. OF SEEDS 9.57962 50 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 68.5	MAXIMUM 83	MINIMUM 55	VARIANCE 76.2778	STD. DEV. 8.73372
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1ST FT 60 SEEDS 3RD FT 76 SEEDS 5TH FT 65 SEEDS 7TH FT 70 SEEDS

2ND FT 83 SEEDS 4TH FT 74 SEEDS 6TH FT 58 SEEDS 8TH FT 67 SEEDS

57.3034 LND. OF SEEDS 78.6966 50 PERCENT OF THE TIME

54.133 LND. OF SEEDS 82.867 50 PERCENT OF THE TIME

TEST NUMBER 49	SETTINGS - <u>Small</u> SPROCKET <u>2</u> GEAR <u>Small</u> CUP <u>8</u> NOTCH	SPECIES L.P.P.	MPH
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SEEDS PER INCH

AVERAGE 6.225	MAXIMUM 15	MINIMUM 1	VARIANCE 6.83	STD. DEV. 2.61768
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2.87427 LND. OF SEEDS 7.57572 50 PERCENT OF THE TIME

1.9255 LND. OF SEEDS 10.5245 50 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 74.7	MAXIMUM 89	MINIMUM 55	VARIANCE 45.7817	STD. DEV. 6.6675
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1ST FT 89 SEEDS 3RD FT 69 SEEDS 5TH FT 73 SEEDS 7TH FT 73 SEEDS

2ND FT 84 SEEDS 4TH FT 82 SEEDS 6TH FT 71 SEEDS 8TH FT 55 SEEDS

66.925 LND. OF SEEDS 83.375 50 PERCENT OF THE TIME

63.5687 LND. OF SEEDS 85.27 50 PERCENT OF THE TIME

TEST NUMBER 50	SETTINGS - <u>Small</u> SPROCKET <u>2</u> GEAR <u>Small</u> CUP <u>8</u> NOTCH	SPECIES Lodgepole Pine	MPH
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SEEDS PER INCH

AVERAGE 6.08333	MAXIMUM 11	MINIMUM 1	VARIANCE 5.32073	STD. DEV. 2.30667
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3.12618 LND. OF SEEDS 9.04082 50 PERCENT OF THE TIME

2.28886 LND. OF SEEDS 9.87786 50 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 73	MAXIMUM 86	MINIMUM 66	VARIANCE 25.3333	STD. DEV. 5.03322
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1ST FT 86 SEEDS 3RD FT 77 SEEDS 5TH FT 67 SEEDS 7TH FT 70 SEEDS

2ND FT 69 SEEDS 4TH FT 69 SEEDS 6TH FT 76 SEEDS 8TH FT 73 SEEDS

66.5474 LND. OF SEEDS 79.4526 50 PERCENT OF THE TIME

64.7203 LND. OF SEEDS 81.2797 50 PERCENT OF THE TIME

TEST NUMBER 51	SETTINGS - <u>Small</u> SPROCKET <u>2</u> GEAR <u>Small</u> CUP <u>8</u> NOTCH	SPECIES Lodgepole Pine	MPH
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SEEDS PER INCH

AVERAGE 5.75833	MAXIMUM 14	MINIMUM 0	VARIANCE 7.83186	STD. DEV. 2.7955
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2.1706 LND. OF SEEDS 9.34602 50 PERCENT OF THE TIME

1.15472 LND. OF SEEDS 10.3619 50 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 69.1	MAXIMUM 82	MINIMUM 59	VARIANCE 57.4333	STD. DEV. 7.57848
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1ST FT 69 SEEDS 3RD FT 60 SEEDS 5TH FT 68 SEEDS 7TH FT 82 SEEDS

2ND FT 64 SEEDS 4TH FT 74 SEEDS 6TH FT 78 SEEDS 8TH FT 59 SEEDS

59.3844 LND. OF SEEDS 78.8156 50 PERCENT OF THE TIME

56.6334 LND. OF SEEDS 84.5666 50 PERCENT OF THE TIME

Wind River Seeder Test Results

TEST NUMBER 52	SETTINGS - <u>Small</u> SPROCKET <u>1</u> GEAR <u>Small</u> CUP <u>1</u> NOTCH	SPECIES <u>Lodgepole Pine</u>	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.18333	8	0	2.82325	1.68025

1029493 L NO. OF SEEDS 4.3342 80 PERCENT OF THE TIME

586682 L NO. OF SEEDS 4.94725 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
26.2	34	15	21.2889	4.61399

1ST FT 29 SEEDS 3RD FT 32 SEEDS 5TH FT 33 SEEDS 7TH FT 27 SEEDS
2ND FT 18 SEEDS 4TH FT 25 SEEDS 6TH FT 24 SEEDS 8TH FT 34 SEEDS

10.2849 L NO. OF SEEDS 32.1151 80 PERCENT OF THE TIME

12.61 L NO. OF SEEDS 33.79 80 PERCENT OF THE TIME

TEST NUMBER 53	SETTINGS - <u>Small</u> SPROCKET <u>1</u> GEAR <u>Small</u> CUP <u>1</u> NOTCH	SPECIES <u>Lodgepole Pine</u>	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.18333	32	15	3.81485	1.95316

320622 L NO. OF SEEDS 4.68229 80 PERCENT OF THE TIME

1.02962 L NO. OF SEEDS 5.39622 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
26.2	11	0	28.6222	5.34997

1ST FT 28 SEEDS 3RD FT 15 SEEDS 5TH FT 32 SEEDS 7TH FT 22 SEEDS
2ND FT 30 SEEDS 4TH FT 32 SEEDS 6TH FT 26 SEEDS 8TH FT 32 SEEDS

19.3413 L NO. OF SEEDS 33.0587 80 PERCENT OF THE TIME

11.3993 L NO. OF SEEDS 35.0007 80 PERCENT OF THE TIME

TEST NUMBER 54	SETTINGS - <u>Small</u> SPROCKET <u>1</u> GEAR <u>Small</u> CUP <u>1</u> NOTCH	SPECIES <u>Lodgepole Pine</u>	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.0667	6	0	2.50308	1.58211

32392 L NO. OF SEEDS 4.79494 80 PERCENT OF THE TIME

225969 L NO. OF SEEDS 4.96924 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
28.4	35	20	42.4889	6.51835

1ST FT 23 SEEDS 3RD FT 30 SEEDS 5TH FT 28 SEEDS 7TH FT 20 SEEDS
2ND FT 25 SEEDS 4TH FT 34 SEEDS 6TH FT 32 SEEDS 8TH FT 30 SEEDS

10.0435 L NO. OF SEEDS 36.7665 80 PERCENT OF THE TIME

17.6773 L NO. OF SEEDS 39.1227 80 PERCENT OF THE TIME

TEST NUMBER 55	SETTINGS - <u>Small</u> SPROCKET <u>4</u> GEAR <u>Small</u> CUP <u>7</u> NOTCH	SPECIES <u>Lodgepole Pine</u>	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
14.2917	22	7	13.9394	3.73355

9.50525 L NO. OF SEEDS 19.0781 80 PERCENT OF THE TIME

8.14997 L NO. OF SEEDS 20.4334 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
171.5	191	141	213.389	14.6078

1ST FT 180 SEEDS 3RD FT 156 SEEDS 5TH FT 176 SEEDS 7TH FT 191 SEEDS
2ND FT 181 SEEDS 4TH FT 141 SEEDS 6TH FT 187 SEEDS 8TH FT 177 SEEDS

152.773 L NO. OF SEEDS 190.227 80 PERCENT OF THE TIME

147.47 L NO. OF SEEDS 195.53 80 PERCENT OF THE TIME

TEST NUMBER 56	SETTINGS - <u>Small</u> SPROCKET <u>1</u> GEAR <u>Large</u> CUP <u>10</u> NOTCH	SPECIES <u>Ponderosa Pine</u>	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.915	8	0	3.75567	1.93796

490541 L NO. OF SEEDS 5.4594 80 PERCENT OF THE TIME

212937 L NO. OF SEEDS 6.16294 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
35.7	42	27	53.1222	7.2715

1ST FT 34 SEEDS 3RD FT 27 SEEDS 5TH FT 31 SEEDS 7TH FT 37 SEEDS
2ND FT 39 SEEDS 4TH FT 42 SEEDS 6TH FT 40 SEEDS 8TH FT 31 SEEDS

26.3561 L NO. OF SEEDS 45.6439 80 PERCENT OF THE TIME

23.7104 L NO. OF SEEDS 47.6896 80 PERCENT OF THE TIME

TEST NUMBER 57	SETTINGS - <u>Small</u> SPROCKET <u>1</u> GEAR <u>Large</u> CUP <u>10</u> NOTCH	SPECIES <u>Ponderosa Pine</u>	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.00833	9	0	3.25567	1.798

702435 L NO. OF SEEDS 5.21423 80 PERCENT OF THE TIME

0495165 L NO. OF SEEDS 5.96715 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
36.1	43	28	49.4333	7.0302

1ST FT 43 SEEDS 3RD FT 30 SEEDS 5TH FT 38 SEEDS 7TH FT 51 SEEDS
2ND FT 38 SEEDS 4TH FT 28 SEEDS 6TH FT 38 SEEDS 8TH FT 37 SEEDS

27.0864 L NO. OF SEEDS 45.1136 80 PERCENT OF THE TIME

24.5342 L NO. OF SEEDS 47.4658 80 PERCENT OF THE TIME

Wind River Seeder Test Results

TEST NUMBER 58	SETTINGS- <u>Small</u> SPROCKET <u>1</u> GEAR <u>Large</u> CUP <u>10</u> NOTCH	SPECIES Ponderosa Pine	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.86667	8	0	2.25518	1.65987

738208 L NO. OF SEEDS 4.99463 80 PERCENT OF THE TIME

136174 L NO. OF SEEDS 5.59716 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
34.4	48	23	16.4889	4.06065

1ST FT 28 SEEDS 3RD FT 42 SEEDS 5TH FT 48 SEEDS 7TH FT 25 SEEDS
2ND FT 32 SEEDS 4TH FT 36 SEEDS 6TH FT 42 SEEDS 8TH FT 36 SEEDS

2 9.1942 L NO. OF SEEDS 23.6058 80 PERCENT OF THE TIME

27.2202 L NO. OF SEEDS 44.0798 80 PERCENT OF THE TIME

TEST NUMBER 61	SETTINGS- <u>Small</u> SPROCKET <u>1</u> GEAR <u>Large</u> CUP <u>5</u> NOTCH	SPECIES Ponderosa Pine	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
1.7963	6	0	1.9955	1.41262

0.0146848 L NO. OF SEEDS 23.60728 80 PERCENT OF THE TIME

527466 L NO. OF SEEDS 4.12006 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
21.5556	36	16	39.7778	6.3067

1ST FT 23 SEEDS 3RD FT 21 SEEDS 5TH FT 36 SEEDS 7TH FT 17 SEEDS
2ND FT 21 SEEDS 4TH FT 19 SEEDS 6TH FT 17 SEEDS 8TH FT 24 SEEDS

13.47 L NO. OF SEEDS 22.6411 80 PERCENT OF THE TIME

11.1806 L NO. OF SEEDS 31.9305 80 PERCENT OF THE TIME

TEST NUMBER 59	SETTINGS- <u>Small</u> SPROCKET <u>1</u> GEAR <u>Large</u> CUP <u>5</u> NOTCH	SPECIES Ponderosa Pine	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
1.96667	9	0	2.41905	1.55533

0.032648 L NO. OF SEEDS 23.9606 80 PERCENT OF THE TIME

591849 L NO. OF SEEDS 4.52518 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
23.6	39	10	26.2667	5.1251

1ST FT 39 SEEDS 3RD FT 28 SEEDS 5TH FT 21 SEEDS 7TH FT 23 SEEDS
2ND FT 22 SEEDS 4TH FT 20 SEEDS 6TH FT 25 SEEDS 8TH FT 18 SEEDS

17.0296 L NO. OF SEEDS 30.1704 80 PERCENT OF THE TIME

15.1692 L NO. OF SEEDS 32.0308 80 PERCENT OF THE TIME

TEST NUMBER 62	SETTINGS- <u>Large</u> SPROCKET <u>2</u> GEAR <u>Large</u> CUP <u>4</u> NOTCH	SPECIES Ponderosa Pine	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.675	12	0	3.96912	1.99226

2.12092 L NO. OF SEEDS 27.22908 80 PERCENT OF THE TIME

1.39772 L NO. OF SEEDS 27.95228 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
56.1	68	50	43.7333	6.5904

1ST FT 50 SEEDS 3RD FT 55 SEEDS 5TH FT 54 SEEDS 7TH FT 52 SEEDS
2ND FT 57 SEEDS 4TH FT 57 SEEDS 6TH FT 63 SEEDS 8TH FT 52 SEEDS

47.6511 L NO. OF SEEDS 64.5489 80 PERCENT OF THE TIME

45.2588 L NO. OF SEEDS 66.9412 80 PERCENT OF THE TIME

TEST NUMBER 60	SETTINGS- <u>Small</u> SPROCKET <u>1</u> GEAR <u>Large</u> CUP <u>5</u> NOTCH	SPECIES Ponderosa Pine	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
1.875	7	0	1.74055	1.3193

18366 L NO. OF SEEDS 23.56634 80 PERCENT OF THE TIME

295245 L NO. OF SEEDS 4.04524 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
22.5	31	8	30.2778	5.50252

1ST FT 24 SEEDS 3RD FT 27 SEEDS 5TH FT 28 SEEDS 7TH FT 21 SEEDS
2ND FT 25 SEEDS 4TH FT 18 SEEDS 6TH FT 24 SEEDS 8TH FT 8 SEEDS

15.4458 L NO. OF SEEDS 29.5542 80 PERCENT OF THE TIME

13.4483 L NO. OF SEEDS 31.5517 80 PERCENT OF THE TIME

TEST NUMBER 63	SETTINGS- <u>Large</u> SPROCKET <u>2</u> GEAR <u>Large</u> CUP <u>4</u> NOTCH	SPECIES Ponderosa Pine	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.65833	10	0	4.19321	2.04773

2.03314 L NO. OF SEEDS 27.28353 80 PERCENT OF THE TIME

1.28981 L NO. OF SEEDS 28.02685 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
55.9	64	49	52.9889	7.27935

1ST FT 49 SEEDS 3RD FT 60 SEEDS 5TH FT 52 SEEDS 7TH FT 52 SEEDS
2ND FT 53 SEEDS 4TH FT 64 SEEDS 6TH FT 56 SEEDS 8TH FT 56 SEEDS

46.5679 L NO. OF SEEDS 65.2321 80 PERCENT OF THE TIME

43.9255 L NO. OF SEEDS 67.0745 80 PERCENT OF THE TIME

Wind River Seeder Test Results

TEST NUMBER 64	SETTINGS- Large SPROCKET 2 Large CUP 4	GEAR NOTCH	SPECIES Ponderosa Pine	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.725	10	0	3.98256	1.99564

2.16657 L NO. OF SEEDS 2728341 80 PERCENT OF THE TIME

1.44218 L NO. OF SEEDS 8.00782 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
56.7	63	52	82.0111	9.056

1ST FT 58 SEEDS 3RD FT 56 SEEDS 5TH FT 57 SEEDS 7TH FT 56 SEEDS
2ND FT 54 SEEDS 4TH FT 56 SEEDS 6TH FT 61 SEEDS 8TH FT 54 SEEDS

9TH FT 52 SEEDS
10TH FT 63 SEEDS

45.0902 L NO. OF SEEDS 683078 80 PERCENT OF THE TIME

41.8029 L NO. OF SEEDS 2715971 90 PERCENT OF THE TIME

TEST NUMBER 70	SETTINGS- Small SPROCKET 2 Large CUP 2	GEAR NOTCH	SPECIES Douglas Fir	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.11667	13	0	4.50728	2.12304

3.94934 L NO. OF SEEDS 5.8384 80 PERCENT OF THE TIME

3.37528 L NO. OF SEEDS 6.60906 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
37.4	59	25	33.6	5.79655

1ST FT 36 SEEDS 3RD FT 34 SEEDS 5TH FT 43 SEEDS 7TH FT 34 SEEDS
2ND FT 25 SEEDS 4TH FT 59 SEEDS 6TH FT 31 SEEDS 8TH FT 43 SEEDS

9TH FT 38 SEEDS
10TH FT 31 SEEDS

29.9688 L NO. OF SEEDS 448312 80 PERCENT OF THE TIME

27.8647 L NO. OF SEEDS 46.9353 90 PERCENT OF THE TIME

TEST NUMBER 68	SETTINGS- Small SPROCKET 2 Large CUP 2	GEAR NOTCH	SPECIES Douglas Fir	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.11667	8	0	3.01148	1.73536

8.91931 L NO. OF SEEDS 5.3414 80 PERCENT OF THE TIME

2.61995 L NO. OF SEEDS 5.97134 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
37.4	49	26	19.6	4.42719

1ST FT 45 SEEDS 3RD FT 36 SEEDS 5TH FT 35 SEEDS 7TH FT 45 SEEDS
2ND FT 38 SEEDS 4TH FT 49 SEEDS 6TH FT 26 SEEDS 8TH FT 28 SEEDS

9TH FT 43 SEEDS
10TH FT 29 SEEDS

31.7243 L NO. OF SEEDS 43.0252 80 PERCENT OF THE TIME

30.1173 L NO. OF SEEDS 44.6027 90 PERCENT OF THE TIME

TEST NUMBER 71	SETTINGS- Small SPROCKET 2 Large CUP 1	GEAR NOTCH	SPECIES Douglas Fir	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.575	7	0	3.46609	1.84556

2.08992 L NO. OF SEEDS 4.94101 80 PERCENT OF THE TIME

4.60947 L NO. OF SEEDS 5.61095 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
30.9	36	24	53.8778	7.401

1ST FT 27 SEEDS 3RD FT 27 SEEDS 5TH FT 34 SEEDS 7TH FT 24 SEEDS
2ND FT 31 SEEDS 4TH FT 26 SEEDS 6TH FT 36 SEEDS 8TH FT 1 SEEDS

9TH FT 36 SEEDS
10TH FT 24 SEEDS

21.4899 L NO. OF SEEDS 40.3101 80 PERCENT OF THE TIME

18.8255 L NO. OF SEEDS 42.9745 90 PERCENT OF THE TIME

TEST NUMBER 69	SETTINGS- Small SPROCKET 2 Large CUP 2	GEAR NOTCH	SPECIES Douglas Fir	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.4	9	0	4.15798	2.03911

7.85857 L NO. OF SEEDS 6.01414 80 PERCENT OF THE TIME

0.56586 L NO. OF SEEDS 6.75434 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
40.8	50	27	137.956	11.7454

1ST FT 49 SEEDS 3RD FT 43 SEEDS 5TH FT 38 SEEDS 7TH FT 44 SEEDS
2ND FT 27 SEEDS 4TH FT 50 SEEDS 6TH FT 41 SEEDS 8TH FT 33 SEEDS

9TH FT 50 SEEDS
10TH FT 34 SEEDS

25.7423 L NO. OF SEEDS 55.8577 80 PERCENT OF THE TIME

21.4787 L NO. OF SEEDS 60.1213 90 PERCENT OF THE TIME

TEST NUMBER 72	SETTINGS- Small SPROCKET 2 Large CUP 1	GEAR NOTCH	SPECIES Douglas Fir	MPH
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SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.03333	9	0	3.52829	1.874

6.25257 L NO. OF SEEDS 5.44141 80 PERCENT OF THE TIME

0.56593 L NO. OF SEEDS 6.12326 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
36.4	46	25	80.2667	8.954

1ST FT 26 SEEDS 3RD FT 33 SEEDS 5TH FT 38 SEEDS 7TH FT 27 SEEDS
2ND FT 46 SEEDS 4TH FT 40 SEEDS 6TH FT 40 SEEDS 8TH FT 40 SEEDS

9TH FT 25 SEEDS
10TH FT 39 SEEDS

24.9143 L NO. OF SEEDS 47.8857 80 PERCENT OF THE TIME

21.6622 L NO. OF SEEDS 51.1378 90 PERCENT OF THE TIME

Wind River Seeder Test Results

TEST NUMBER 73	SETTINGS- <u>small</u> SPROCKET <u>2</u> GEAR <u>large</u> CUP <u>2</u> NOTCH	SPECIES Douglas Fir	MPH
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SEEDS PER INCH

AVERAGE 2.925	MAXIMUM 9	MINIMUM 0	VARIANCE 3.59937	STD. DEV. 1.8972
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49.2789 LND. OF SEEDS 25.3572 80 PERCENT OF THE TIME
- 19.5895 LND. OF SEEDS 26.0458 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 35.1	MAXIMUM 46	MINIMUM 21	VARIANCE 65.2111	STD. DEV. 8.07534
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1ST FT 46 SEEDS 3RD FT 33 SEEDS 5TH FT 35 SEEDS 7TH FT 30 SEEDS
2ND FT 21 SEEDS 4TH FT 39 SEEDS 6TH FT 39 SEEDS 8TH FT 28 SEEDS
24.7474 L NO. OF SEEDS 45.4526 80 PERCENT OF THE TIME 9TH FT 40 SEEDS
21.8161 L NO. OF SEEDS 48.3839 90 PERCENT OF THE TIME 10TH FT 40 SEEDS

TEST NUMBER 74	SETTINGS- <u>small</u> SPROCKET <u>2</u> GEAR <u>large</u> CUP <u>10</u> NOTCH	SPECIES Douglas Fir	MPH
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SEEDS PER INCH

AVERAGE 7.38589	MAXIMUM 18	MINIMUM 1	VARIANCE 11.2679	STD. DEV. 3.35677
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2.08551 LND. OF SEEDS 11.6923 80 PERCENT OF THE TIME
1.867 LND. OF SEEDS 12.9108 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 88.6667	MAXIMUM 108	MINIMUM 64	VARIANCE 193.25	STD. DEV. 13.9014
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1ST FT 105 SEEDS 3RD FT 66 SEEDS 5TH FT 108 SEEDS 7TH FT 90 SEEDS
2ND FT 80 SEEDS 4TH FT 88 SEEDS 6TH FT 98 SEEDS 8TH FT 64 SEEDS
70.845 L NO. OF SEEDS 106.488 80 PERCENT OF THE TIME 9TH FT 99 SEEDS
55.7988 L NO. OF SEEDS 111.535 90 PERCENT OF THE TIME 10TH FT --- SEEDS

TEST NUMBER 75	SETTINGS- <u>small</u> SPROCKET <u>2</u> GEAR <u>large</u> CUP <u>10</u> NOTCH	SPECIES Douglas Fir	MPH
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SEEDS PER INCH

AVERAGE 7.44167	MAXIMUM 17	MINIMUM 0	VARIANCE 7.72766	STD. DEV. 2.77987
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1.87788 LND. OF SEEDS 11.0055 80 PERCENT OF THE TIME
2.86879 LND. OF SEEDS 12.0145 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 89.3	MAXIMUM 104	MINIMUM 75	VARIANCE 91.5667	STD. DEV. 9.56905
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1ST FT 75 SEEDS 3RD FT 75 SEEDS 5TH FT 87 SEEDS 7TH FT 82 SEEDS
2ND FT 104 SEEDS 4TH FT 96 SEEDS 6TH FT 85 SEEDS 8TH FT 104 SEEDS
71.0325 L NO. OF SEEDS 101.568 80 PERCENT OF THE TIME 9TH FT 84 SEEDS
73.5589 L NO. OF SEEDS 105.041 90 PERCENT OF THE TIME 10TH FT 101 SEEDS

TEST NUMBER 76	SETTINGS- <u>small</u> SPROCKET <u>2</u> GEAR <u>large</u> CUP <u>10</u> NOTCH	SPECIES Douglas Fir	MPH
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SEEDS PER INCH

AVERAGE 7.24167	MAXIMUM 15	MINIMUM 1	VARIANCE 6.31916	STD. DEV. 2.1281
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4.01896 LND. OF SEEDS 10.4644 80 PERCENT OF THE TIME
3.10644 LND. OF SEEDS 11.3769 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 86.9	MAXIMUM 99	MINIMUM 77	VARIANCE 20.9881	STD. DEV. 4.581
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1ST FT 83 SEEDS 3RD FT 87 SEEDS 5TH FT 88 SEEDS 7TH FT 59 SEEDS
2ND FT 66 SEEDS 4TH FT 99 SEEDS 6TH FT 89 SEEDS 8TH FT 27 SEEDS
81.0267 L NO. OF SEEDS 92.7233 80 PERCENT OF THE TIME 9TH FT --- SEEDS
79.3637 L NO. OF SEEDS 94.4360 90 PERCENT OF THE TIME 10TH FT 12 SEEDS

TEST NUMBER 78	SETTINGS- <u>large</u> SPROCKET <u>4</u> GEAR <u>large</u> CUP <u>5</u> NOTCH	SPECIES Douglas Fir	MPH
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SEEDS PER INCH

AVERAGE 9.54167	MAXIMUM 20	MINIMUM 3	VARIANCE 11.3596	STD. DEV. 3.371
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5.22081 LND. OF SEEDS 13.8625 80 PERCENT OF THE TIME
3.99736 LND. OF SEEDS 15.086 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 114.5	MAXIMUM 138	MINIMUM 82	VARIANCE 130.22	STD. DEV. 11.4074
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1ST FT 120 SEEDS 3RD FT 82 SEEDS 5TH FT 96 SEEDS 7TH FT 121 SEEDS
2ND FT 102 SEEDS 4TH FT 135 SEEDS 6TH FT 138 SEEDS 8TH FT 161 SEEDS
99.8424 L NO. OF SEEDS 122.158 80 PERCENT OF THE TIME 9TH FT 127 SEEDS
95.6921 L NO. OF SEEDS 132.308 90 PERCENT OF THE TIME 10TH FT --- SEEDS

TEST NUMBER 79	SETTINGS- <u>large</u> SPROCKET <u>2</u> GEAR <u>large</u> CUP <u>4</u> NOTCH	SPECIES Douglas Fir	MPH
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SEEDS PER INCH

AVERAGE 4.84167	MAXIMUM 11	MINIMUM 0	VARIANCE 5.36127	STD. DEV. 2.3158
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1.87327 LND. OF SEEDS 7.81006 80 PERCENT OF THE TIME
1.83276 LND. OF SEEDS 8.65057 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 58.1	MAXIMUM 80	MINIMUM 40	VARIANCE 118.322	STD. DEV. 10.876
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1ST FT 57 SEEDS 3RD FT 40 SEEDS 5TH FT 56 SEEDS 7TH FT 52 SEEDS
2ND FT 53 SEEDS 4TH FT 80 SEEDS 6TH FT 66 SEEDS 8TH FT 52 SEEDS
44.1549 L NO. OF SEEDS 72.0451 80 PERCENT OF THE TIME 9TH FT 66 SEEDS
40.2063 L NO. OF SEEDS 75.9937 90 PERCENT OF THE TIME 10TH FT 60 SEEDS

Wind River Seeder Test Results

TEST NUMBER 80	SETTINGS - <u>Large</u> SPROCKET <u>4</u> GEAR <u>Small</u> CUP <u>5</u> NOTCH	SPECIES Doug (33 F. r)	MPN
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SEEDS PER INCH

AVERAGE 1.85	MAXIMUM 7	MINIMUM 0	VARIANCE 2.34706	STD. DEV. 1.53201
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- .114039 L NO. OF SEEDS 23.81404 80 PERCENT OF THE TIME
 - .670159 L NO. OF SEEDS 4.37016 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 22.2	MAXIMUM 29	MINIMUM 14	VARIANCE 37.9556	STD. DEV. 6.16081
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1ST FT 29 SEEDS 3RD FT 14 SEEDS 5TH FT 25 SEEDS 7TH FT 29 SEEDS
 2ND FT 16 SEEDS 4TH FT 23 SEEDS 6TH FT 23 SEEDS 8TH FT 18 SEEDS
 14.3018 L NO. OF SEEDS 30.0982 80 PERCENT OF THE TIME 9TH FT 18 SEEDS
 12.0655 L NO. OF SEEDS 32.3345 90 PERCENT OF THE TIME 10TH FT 29 SEEDS

Ventura Seeder Test Results

TEST NUMBER 1	GATE SETTING .175"	SPECIES Ponderosa Pine	MPH 2.27
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SEEDS PER INCH

AVERAGE 5	MAXIMUM 5	MINIMUM 0	VARIANCE .192647	STD. DEV. .899297
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274 NO. OF SEEDS 2.06637 80 PERCENT OF THE TIME

5.7555 NO. OF SEEDS 2.38956 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 16	MAXIMUM 16	MINIMUM 7	VARIANCE 4.78887	STD. DEV. 2.2350
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1ST FT 9 SEEDS 3RD FT 11 SEEDS 5TH FT 13 SEEDS 7TH FT 16 SEEDS

2ND FT 10 SEEDS 4TH FT 7 SEEDS 6TH FT 14 SEEDS 8TH FT 11 SEEDS

5.7055 NO. OF SEEDS 13.9635 80 PERCENT OF THE TIME

5.70 NO. OF SEEDS 14.7772 90 PERCENT OF THE TIME

TEST NUMBER 2	GATE SETTING .175"	SPECIES Ponderosa Pine	MPH 2.5
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SEEDS PER INCH

AVERAGE .816667	MAXIMUM 4	MINIMUM 0	VARIANCE .940896	STD. DEV. .969998
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4.2631 NO. OF SEEDS 2.0602 80 PERCENT OF THE TIME

7.7899 NO. OF SEEDS 2.4131 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 9.8	MAXIMUM 16	MINIMUM 4	VARIANCE 14.6222	STD. DEV. 3.8239
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1ST FT 11 SEEDS 3RD FT 11 SEEDS 5TH FT 9 SEEDS 7TH FT 11 SEEDS

2ND FT 12 SEEDS 4TH FT 16 SEEDS 6TH FT 9 SEEDS 8TH FT 8 SEEDS

4.8976 NO. OF SEEDS 14.7023 80 PERCENT OF THE TIME

3.5096 NO. OF SEEDS 16.0923 90 PERCENT OF THE TIME

TEST NUMBER 3	GATE SETTING .175"	SPECIES Ponderosa Pine	MPH 2.1
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SEEDS PER INCH

AVERAGE 2.08333	MAXIMUM 6	MINIMUM 0	VARIANCE 1.79132	STD. DEV. 1.3384
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3.67504 NO. OF SEEDS 2.7994 80 PERCENT OF THE TIME

1.18336 NO. OF SEEDS 4.285 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 25	MAXIMUM 32	MINIMUM 17	VARIANCE 21.7778	STD. DEV. 4.66667
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1ST FT 17 SEEDS 3RD FT 29 SEEDS 5TH FT 27 SEEDS 7TH FT 21 SEEDS

2ND FT 30 SEEDS 4TH FT 28 SEEDS 6TH FT 32 SEEDS 8TH FT 26 SEEDS

19.0173 NO. OF SEEDS 30.9827 80 PERCENT OF THE TIME

17.3233 NO. OF SEEDS 32.6767 90 PERCENT OF THE TIME

TEST NUMBER 4	GATE SETTING .175	SPECIES Ponderosa Pine	MPH 2.1
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SEEDS PER INCH

AVERAGE 1.275	MAXIMUM 4	MINIMUM 0	VARIANCE 1.37952	STD. DEV. 1.17364
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2.29656 NO. OF SEEDS 2.77966 80 PERCENT OF THE TIME

6.55701 NO. OF SEEDS 3.2057 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 15.3	MAXIMUM 26	MINIMUM 4	VARIANCE 14.4556	STD. DEV. 3.90582
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1ST FT 26 SEEDS 3RD FT 16 SEEDS 5TH FT 25 SEEDS 7TH FT 4 SEEDS

2ND FT 17 SEEDS 4TH FT 12 SEEDS 6TH FT 16 SEEDS 8TH FT 8 SEEDS

10.4258 NO. OF SEEDS 20.1742 80 PERCENT OF THE TIME

9.04563 NO. OF SEEDS 21.5544 90 PERCENT OF THE TIME

TEST NUMBER 5	GATE SETTING .215"	SPECIES Ponderosa Pine	MPH 2.3
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SEEDS PER INCH

AVERAGE 2.90833	MAXIMUM 9	MINIMUM 0	VARIANCE 3.3621	STD. DEV. 1.8
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5.57943 NO. OF SEEDS 5.25028 80 PERCENT OF THE TIME

10.7573 NO. OF SEEDS 5.92424 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 34.9	MAXIMUM 48	MINIMUM 25	VARIANCE 13.4333	STD. DEV. 5.0671
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1ST FT 42 SEEDS 3RD FT 25 SEEDS 5TH FT 38 SEEDS 7TH FT 34 SEEDS

2ND FT 41 SEEDS 4TH FT 29 SEEDS 6TH FT 32 SEEDS 8TH FT 28 SEEDS

30.2013 NO. OF SEEDS 39.5987 80 PERCENT OF THE TIME

28.8208 NO. OF SEEDS 40.9292 90 PERCENT OF THE TIME

TEST NUMBER 6	GATE SETTING .215"	SPECIES Ponderosa Pine	MPH 2.3
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SEEDS PER INCH

AVERAGE 3.55952	MAXIMUM 8	MINIMUM 1	VARIANCE 2.73135	STD. DEV. 1.65208
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1.44079 NO. OF SEEDS 5.67826 80 PERCENT OF THE TIME

8.40864 NO. OF SEEDS 6.27918 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 42.7143	MAXIMUM 53	MINIMUM 33	VARIANCE 45.2381	STD. DEV. 6.7593
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1ST FT 48 SEEDS 3RD FT 41 SEEDS 5TH FT 33 SEEDS 7TH FT 43 SEEDS

2ND FT 42 SEEDS 4TH FT 53 SEEDS 6TH FT 39 SEEDS 8TH FT SEEDS

34.0916 NO. OF SEEDS 51.3369 80 PERCENT OF THE TIME

31.6501 NO. OF SEEDS 53.7784 90 PERCENT OF THE TIME

Ventura Seeder Test Results

TEST NUMBER	GATE SETTING	SPECIES	MPH
7	.215"	Ponderosa Pine	2.2

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.85233	9	0	3.90413	1.97589

2.5245 L NO. OF SEEDS 25.39142 80 PERCENT OF THE TIME

2.39262 L NO. OF SEEDS 24.10867 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
34.3	44	29	61.3444	7.83227

1ST FT 36 SEEDS 3RD FT 32 SEEDS 5TH FT 26 SEEDS 7TH FT 37 SEEDS

2ND FT 41 SEEDS 4TH FT 34 SEEDS 6TH FT 31 SEEDS 8TH FT 29 SEEDS

24.259 L NO. OF SEEDS 244.341 80 PERCENT OF THE TIME

21.459 L NO. OF SEEDS 247.181 90 PERCENT OF THE TIME

9TH FT 23 SEEDS

10TH FT 44 SEEDS

TEST NUMBER	GATE SETTING	SPECIES	MPH
8	.215	Ponderosa Pine	2.2

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.01667	9	0	3.4451	1.8561

6.3715 L NO. OF SEEDS 25.37616 80 PERCENT OF THE TIME

6.0366138 L NO. OF SEEDS 26.06995 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
36.2	57	28	31.2889	5.59365

1ST FT 37 SEEDS 3RD FT 29 SEEDS 5TH FT 28 SEEDS 7TH FT 57 SEEDS

2ND FT 29 SEEDS 4TH FT 37 SEEDS 6TH FT 45 SEEDS 8TH FT 27 SEEDS

29.0289 L NO. OF SEEDS 243.3711 80 PERCENT OF THE TIME

26.9985 L NO. OF SEEDS 245.4015 90 PERCENT OF THE TIME

9TH FT 29 SEEDS

10TH FT 44 SEEDS

TEST NUMBER	GATE SETTING	SPECIES	MPH
9	.150	Douglas Fir	2.5

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.8	9	0	3.94286	1.98566

1.25438 L NO. OF SEEDS 26.34562 80 PERCENT OF THE TIME

5.33585 L NO. OF SEEDS 27.66422 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
45.6	53	32	60.9333	7.80598

1ST FT 43 SEEDS 3RD FT 35 SEEDS 5TH FT 53 SEEDS 7TH FT 52 SEEDS

2ND FT 49 SEEDS 4TH FT 51 SEEDS 6TH FT 46 SEEDS 8TH FT 51 SEEDS

35.5927 L NO. OF SEEDS 255.6272 80 PERCENT OF THE TIME

32.2592 L NO. OF SEEDS 258.4468 90 PERCENT OF THE TIME

9TH FT 44 SEEDS

10TH FT 32 SEEDS

TEST NUMBER	GATE SETTING	SPECIES	MPH
10	.150	Douglas Fir	2.5

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.38333	12	0	4.52469	2.12699

1.65653 L NO. OF SEEDS 27.11014 80 PERCENT OF THE TIME

8.84434 L NO. OF SEEDS 27.88223 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
52.6	57	44	87.3778	9.34261

1ST FT 52 SEEDS 3RD FT 47 SEEDS 5TH FT 55 SEEDS 7TH FT 57 SEEDS

2ND FT 57 SEEDS 4TH FT 44 SEEDS 6TH FT 67 SEEDS 8TH FT 56 SEEDS

46.6164 L NO. OF SEEDS 264.5836 80 PERCENT OF THE TIME

37.2232 L NO. OF SEEDS 267.9768 90 PERCENT OF THE TIME

9TH FT 47 SEEDS

10TH FT 58 SEEDS

TEST NUMBER	GATE SETTING	SPECIES	MPH
11	.150	Douglas Fir	2.3

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.54167	14	0	3.77976	1.94416

2.04925 L NO. OF SEEDS 27.03468 80 PERCENT OF THE TIME

1.34352 L NO. OF SEEDS 27.73981 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
54.5	65	44	22.2778	4.71993

1ST FT 60 SEEDS 3RD FT 65 SEEDS 5TH FT 48 SEEDS 7TH FT 54 SEEDS

2ND FT 57 SEEDS 4TH FT 51 SEEDS 6TH FT 61 SEEDS 8TH FT 49 SEEDS

48.449 L NO. OF SEEDS 260.551 80 PERCENT OF THE TIME

46.7357 L NO. OF SEEDS 262.2642 90 PERCENT OF THE TIME

9TH FT 44 SEEDS

10TH FT 56 SEEDS

TEST NUMBER	GATE SETTING	SPECIES	MPH
12	.062	Western Hemlock	2.7

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
5.66667	18	0	13.014	3.60749

1.04186 L NO. OF SEEDS 210.2915 80 PERCENT OF THE TIME

2.267659 L NO. OF SEEDS 211.601 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
68	106	23	134	11.5758

1ST FT 57 SEEDS 3RD FT 89 SEEDS 5TH FT 58 SEEDS 7TH FT 106 SEEDS

2ND FT 88 SEEDS 4TH FT 23 SEEDS 6TH FT 79 SEEDS 8TH FT 31 SEEDS

53.1598 L NO. OF SEEDS 282.8402 80 PERCENT OF THE TIME

48.9527 L NO. OF SEEDS 287.0423 90 PERCENT OF THE TIME

9TH FT 49 SEEDS

10TH FT 100 SEEDS

Ventura Seeder Test Results

TEST NUMBER 13	GATE SETTING .062	SPECIES W. T. 11/2 W. T. 11/2	MPH 2.9
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SEEDS PER INCH

AVERAGE 505.833	MAXIMUM 12	MINIMUM 0	VARIANCE 6.3243	STD. DEV. 2.51482
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1.83434 L NO. OF SEEDS 8.28233 80 PERCENT OF THE TIME

9.21461 L NO. OF SEEDS 9.19521 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 60.7	MAXIMUM 76	MINIMUM 34	VARIANCE 53.3444	STD. DEV. 7.30373
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1ST FT. 67 SEEDS 3RD FT. 34 SEEDS 5TH FT. 53 SEEDS 7TH FT. 63 SEEDS
2ND FT. 67 SEEDS 4TH FT. 42 SEEDS 6TH FT. 71 SEEDS 8TH FT. 75 SEEDS

51.3366 L NO. OF SEEDS 70.0634 80 PERCENT OF THE TIME

48.6854 L NO. OF SEEDS 72.7146 90 PERCENT OF THE TIME

9TH FT. 59 SEEDS
10TH FT. 76 SEEDS

TEST NUMBER 14	GATE SETTING .062	SPECIES W. T. 11/2 W. T. 11/2	MPH 2.8
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SEEDS PER INCH

AVERAGE 4.93333	MAXIMUM 18	MINIMUM 0	VARIANCE 12.2308	STD. DEV. 3.49726
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4.49849 L NO. OF SEEDS 9.41682 80 PERCENT OF THE TIME

8.819656 L NO. OF SEEDS 10.6863 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE 59.2	MAXIMUM 103	MINIMUM 9	VARIANCE	STD. DEV.
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1ST FT. 57 SEEDS 3RD FT. 68 SEEDS 5TH FT. 40 SEEDS 7TH FT. 29 SEEDS
2ND FT. 56 SEEDS 4TH FT. 103 SEEDS 6TH FT. 9 SEEDS 8TH FT. 93 SEEDS

_____ L NO. OF SEEDS _____ 80 PERCENT OF THE TIME

_____ L NO. OF SEEDS _____ 90 PERCENT OF THE TIME

9TH FT. 90 SEEDS
10TH FT. 53 SEEDS

Øyjord Seeder Test Results

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
1	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
1.8	6	0	1.842	1.357

06.0578 L NO. OF SEEDS 23.539940 PERCENT OF THE TIME

- 432609 L NO. OF SEEDS 4.032610 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
21.6	31	8	17.82	4.22

1ST FT 31 SEEDS 3RD FT 16 SEEDS 5TH FT 22 SEEDS 7TH FT 21 SEEDS

2ND FT 8 SEEDS 4TH FT 22 SEEDS 6TH FT 24 SEEDS 8TH FT 24 SEEDS

16.1871 L NO. OF SEEDS 22.01210 PERCENT OF THE TIME

14.6554 L NO. OF SEEDS 28.54460 PERCENT OF THE TIME

9TH FT 19 SEEDS

10TH FT 29 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
2	1	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
1.633	5	0	1.713	1.309

- 04465 L NO. OF SEEDS 23.31320 PERCENT OF THE TIME

- 519773 L NO. OF SEEDS 23.786440 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
19.6	26	10	22.933	4.789

1ST FT 10 SEEDS 3RD FT 16 SEEDS 5TH FT 17 SEEDS 7TH FT 26 SEEDS

2ND FT 16 SEEDS 4TH FT 15 SEEDS 6TH FT 26 SEEDS 8TH FT 24 SEEDS

13.4607 L NO. OF SEEDS 25.73430 PERCENT OF THE TIME

11.7223 L NO. OF SEEDS 22.47770 PERCENT OF THE TIME

9TH FT 23 SEEDS

10TH FT 23 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
2	2	PP		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
1.55	6	0	1.426	1.194

0190695 L NO. OF SEEDS 23.080930 PERCENT OF THE TIME

- 414415 L NO. OF SEEDS 23.514420 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
18.6	24	9	12.044	3.471

1ST FT 9 SEEDS 3RD FT 23 SEEDS 5TH FT 21 SEEDS 7TH FT 22 SEEDS

2ND FT 14 SEEDS 4TH FT 16 SEEDS 6TH FT 18 SEEDS 8TH FT 24 SEEDS

14.1508 L NO. OF SEEDS 23.04420 PERCENT OF THE TIME

12.891 L NO. OF SEEDS 24.3090 PERCENT OF THE TIME

9TH FT 23 SEEDS

10TH FT 16 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
3	1	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.05	7	0	2.199	1.483

14885 L NO. OF SEEDS 23.951150 PERCENT OF THE TIME

- 389463 L NO. OF SEEDS 24.487460 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
24.6	34	15	21.8222	4.6743

1ST FT 28 SEEDS 3RD FT 29 SEEDS 5TH FT 28 SEEDS 7TH FT 25 SEEDS

2ND FT 22 SEEDS 4TH FT 22 SEEDS 6TH FT 26 SEEDS 8TH FT 15 SEEDS

18.6112 L NO. OF SEEDS 20.58680 PERCENT OF THE TIME

16.9155 L NO. OF SEEDS 22.28450 PERCENT OF THE TIME

9TH FT 34 SEEDS

10TH FT 17 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
3	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.075	7	0	2.32206	1.52383

12145 L NO. OF SEEDS 24.028350 PERCENT OF THE TIME

- 931201 L NO. OF SEEDS 24.58170 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
24.9	38	12	30.544	5.527

1ST FT 25 SEEDS 3RD FT 19 SEEDS 5TH FT 29 SEEDS 7TH FT 20 SEEDS

2ND FT 12 SEEDS 4TH FT 27 SEEDS 6TH FT 19 SEEDS 8TH FT 38 SEEDS

17.8148 L NO. OF SEEDS 23.98520 PERCENT OF THE TIME

15.8086 L NO. OF SEEDS 23.99140 PERCENT OF THE TIME

9TH FT 28 SEEDS

10TH FT 22 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
4	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.91667	10	0	4.16106	2.03987

1.30155 L NO. OF SEEDS 26.531780 PERCENT OF THE TIME

561083 L NO. OF SEEDS 27.22250 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
47	61	36	14.444	3.801

1ST FT 46 SEEDS 3RD FT 36 SEEDS 5TH FT 51 SEEDS 7TH FT 55 SEEDS

2ND FT 46 SEEDS 4TH FT 47 SEEDS 6TH FT 47 SEEDS 8TH FT 61 SEEDS

42.1277 L NO. OF SEEDS 25.18230 PERCENT OF THE TIME

40.748 L NO. OF SEEDS 25.2520 PERCENT OF THE TIME

9TH FT 43 SEEDS

10TH FT 38 SEEDS

Øyjord Seeder Test Results

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
4	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.233	12	0	5.797	2.408

1.54661 L NO. OF SEEDS 21.2465% PERCENT OF THE TIME

4.72605 L NO. OF SEEDS 28.5740% PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
55.6	70	44	71.6	8.46168

1ST FT 3 SEEDS 2ND FT 47 SEEDS 3TH FT 51 SEEDS 4TH FT 63 SEEDS

5TH FT 44 SEEDS 6TH FT 55 SEEDS 7TH FT 70 SEEDS 8TH FT 64 SEEDS

44.7521 L NO. OF SEEDS 26.747% PERCENT OF THE TIME

41.6805 L NO. OF SEEDS 26.9518% PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
5	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.925	14	0	4.85987	2.20451

1.09882 L NO. OF SEEDS 26.2518% PERCENT OF THE TIME

2.98517 L NO. OF SEEDS 27.5514% PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
47.1	73	29	32.989	5.744

1ST FT 29 SEEDS 2ND FT 41 SEEDS 3TH FT 50 SEEDS 4TH FT 55 SEEDS

5TH FT 48 SEEDS 6TH FT 42 SEEDS 7TH FT 73 SEEDS 8TH FT 39 SEEDS

39.7367 L NO. OF SEEDS 25.4463% PERCENT OF THE TIME

37.5518 L NO. OF SEEDS 25.6518% PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
5	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.95833	10	0	4.41001	2.1

1.24613 L NO. OF SEEDS 26.6581% PERCENT OF THE TIME

5.03828 L NO. OF SEEDS 27.4128% PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
47.5	59	40	75.1667	8.66987

1ST FT 40 SEEDS 2ND FT 41 SEEDS 3TH FT 59 SEEDS 4TH FT 59 SEEDS

5TH FT 42 SEEDS 6TH FT 48 SEEDS 7TH FT 55 SEEDS 8TH FT 41 SEEDS

36.3852 L NO. OF SEEDS 25.6148% PERCENT OF THE TIME

33.2381 L NO. OF SEEDS 26.1617% PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
6	2	D.F.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.217	9	0	3.734	1.932

7.79329 L NO. OF SEEDS 25.674% PERCENT OF THE TIME

6.37867 L NO. OF SEEDS 26.3952% PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
38.6	47	27	38.933	6.2391

1ST FT 31 SEEDS 2ND FT 46 SEEDS 3TH FT 46 SEEDS 4TH FT 42 SEEDS

5TH FT 30 SEEDS 6TH FT 47 SEEDS 7TH FT 27 SEEDS 8TH FT 40 SEEDS

30.6008 L NO. OF SEEDS 26.5772% PERCENT OF THE TIME

28.3358 L NO. OF SEEDS 26.8672% PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
6	2	DF		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.025	8	0	3.319	1.822

6.87543 L NO. OF SEEDS 25.3604% PERCENT OF THE TIME

10.782554 L NO. OF SEEDS 26.6214% PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
36.3	56	27	55.344	7.4373

1ST FT 30 SEEDS 2ND FT 36 SEEDS 3TH FT 31 SEEDS 4TH FT 32 SEEDS

5TH FT 37 SEEDS 6TH FT 42 SEEDS 7TH FT 34 SEEDS 8TH FT 56 SEEDS

26.7627 L NO. OF SEEDS 25.8214% PERCENT OF THE TIME

24.0622 L NO. OF SEEDS 24.8538% PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
7	1	DF		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.858	8	0	2.946	1.716

6.57864 L NO. OF SEEDS 25.5683% PERCENT OF THE TIME

10.347981 L NO. OF SEEDS 25.6883% PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
34.3	43	22	22.223	4.715

1ST FT 27 SEEDS 2ND FT 22 SEEDS 3TH FT 31 SEEDS 4TH FT 10 SEEDS

5TH FT 33 SEEDS 6TH FT 42 SEEDS 7TH FT 33 SEEDS 8TH FT 43 SEEDS

28.2551 L NO. OF SEEDS 24.2442% PERCENT OF THE TIME

26.5435 L NO. OF SEEDS 24.2565% PERCENT OF THE TIME

Øyjord Seeder Test Results

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
7	2	DF		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.50833	9	0	2.975	1.725

29722 L NO. OF SEEDS 4.71945 PERCENT OF THE TIME

32286 L NO. OF SEEDS 5.3453 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
30.1	44	19	45.433	6.74

1ST FT 22 SEEDS 2ND FT 26 SEEDS 3TH FT 30 SEEDS 4TH FT 26 SEEDS

5TH FT 19 SEEDS 6TH FT 33 SEEDS 7TH FT 27 SEEDS 8TH FT 41 SEEDS

11.4522 L NO. OF SEEDS 28.7412 PERCENT OF THE TIME

17.012 L NO. OF SEEDS 41.188 PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
8	1	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.233	7	0	2.382	1.543

2.54699 L NO. OF SEEDS 4.24122 PERCENT OF THE TIME

325554 L NO. OF SEEDS 4.77223 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
26.8	34	17	15.511	3.938

1ST FT 17 SEEDS 2ND FT 26 SEEDS 3TH FT 24 SEEDS 4TH FT 29 SEEDS

5TH FT 32 SEEDS 6TH FT 24 SEEDS 7TH FT 34 SEEDS 8TH FT 29 SEEDS

21.151 L NO. OF SEEDS 23.849 PERCENT OF THE TIME

20.2413 L NO. OF SEEDS 23.212 PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
8	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.19167	6	0	2.492	1.579

167744 L NO. OF SEEDS 4.21522 PERCENT OF THE TIME

405333 L NO. OF SEEDS 4.7886 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
26.3	33	17	16.456	4.057

1ST FT 27 SEEDS 2ND FT 17 SEEDS 3TH FT 19 SEEDS 4TH FT 32 SEEDS

5TH FT 23 SEEDS 6TH FT 28 SEEDS 7TH FT 20 SEEDS 8TH FT 28 SEEDS

21.0995 L NO. OF SEEDS 23.545 PERCENT OF THE TIME

19.627 L NO. OF SEEDS 23.973 PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
9	1	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.183	9	0	3.025	1.739

0.0463628 L NO. OF SEEDS 4.41303 PERCENT OF THE TIME

6.77704 L NO. OF SEEDS 5.6443 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
26.2	35	15	61.067	7.815

1ST FT 15 SEEDS 2ND FT 29 SEEDS 3TH FT 29 SEEDS 4TH FT 26 SEEDS

5TH FT 17 SEEDS 6TH FT 25 SEEDS 7TH FT 35 SEEDS 8TH FT 24 SEEDS

16.1212 L NO. OF SEEDS 26.212 PERCENT OF THE TIME

13.3451 L NO. OF SEEDS 29.6597 PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
9	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.025	8	0	2.058	1.435

185791 L NO. OF SEEDS 23.8642 PERCENT OF THE TIME

324984 L NO. OF SEEDS 4.38478 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
24.3	35	14	22.456	4.739

1ST FT 14 SEEDS 2ND FT 26 SEEDS 3TH FT 18 SEEDS 4TH FT 23 SEEDS

5TH FT 15 SEEDS 6TH FT 26 SEEDS 7TH FT 35 SEEDS 8TH FT 20 SEEDS

12.2249 L NO. OF SEEDS 20.225 PERCENT OF THE TIME

16.5642 L NO. OF SEEDS 23.0952 PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
10	1	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.55	10	0	5.342	2.311

1.52694 L NO. OF SEEDS 2.51306 PERCENT OF THE TIME

7.47944 L NO. OF SEEDS 18.35206 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
54.6	67	47	29.378	5.42

1ST FT 59 SEEDS 2ND FT 47 SEEDS 3TH FT 47 SEEDS 4TH FT 61 SEEDS

5TH FT 54 SEEDS 6TH FT 49 SEEDS 7TH FT 67 SEEDS 8TH FT 53 SEEDS

47.6514 L NO. OF SEEDS 61.5486 PERCENT OF THE TIME

45.6839 L NO. OF SEEDS 63.7161 PERCENT OF THE TIME

Øyjord Seeder Test Results

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
10	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.325	13	0	5.011	2.239

1. 45517 L NO. OF SEEDS 27.19483 80 PERCENT OF THE TIME

6. 42575 L NO. OF SEEDS 28.00743 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
51.9	62	42	50.1	7.078

1ST FT 45 SEEDS 3RD FT 49 SEEDS 5TH FT 53 SEEDS 7TH FT 60 SEEDS

2ND FT 49 SEEDS 4TH FT 56 SEEDS 6TH FT 62 SEEDS 8TH FT 58 SEEDS

42.8258 L NO. OF SEEDS 60.9742 80 PERCENT OF THE TIME

40.2565 L NO. OF SEEDS 63.5435 90 PERCENT OF THE TIME

9TH FT 42 SEEDS
10TH FT 45 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
11	1	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.917	15	0	7.69	2.773

1. 36146 L NO. OF SEEDS 28.47182 80 PERCENT OF THE TIME

3. 54801 L NO. OF SEEDS 29.47853 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
59	79	44	57.111	7.557

1ST FT 44 SEEDS 3RD FT 45 SEEDS 5TH FT 48 SEEDS 7TH FT 70 SEEDS

2ND FT 54 SEEDS 4TH FT 53 SEEDS 6TH FT 53 SEEDS 8TH FT 70 SEEDS

49.3117 L NO. OF SEEDS 68.6883 80 PERCENT OF THE TIME

46.5684 L NO. OF SEEDS 71.4316 90 PERCENT OF THE TIME

9TH FT 79 SEEDS
10TH FT 74 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
11	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.042	12	0	4.729	2.175

1. 25369 L NO. OF SEEDS 26.82764 80 PERCENT OF THE TIME

4. 64277 L NO. OF SEEDS 27.61706 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
48.5	60	37	90.278	9.501

1ST FT 37 SEEDS 3RD FT 38 SEEDS 5TH FT 56 SEEDS 7TH FT 51 SEEDS

2ND FT 60 SEEDS 4TH FT 44 SEEDS 6TH FT 50 SEEDS 8TH FT 49 SEEDS

36.3191 L NO. OF SEEDS 60.6809 80 PERCENT OF THE TIME

32.8761 L NO. OF SEEDS 64.1239 90 PERCENT OF THE TIME

9TH FT 56 SEEDS
10TH FT 44 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
12	1	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.617	13	1	4.776	2.185

1. 81492 L NO. OF SEEDS 27.41841 80 PERCENT OF THE TIME

1. 6216 L NO. OF SEEDS 28.21173 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
55.4	73	37	68.044	8.249

1ST FT 50 SEEDS 3RD FT 55 SEEDS 5TH FT 54 SEEDS 7TH FT 37 SEEDS

2ND FT 48 SEEDS 4TH FT 56 SEEDS 6TH FT 59 SEEDS 8TH FT 73 SEEDS

44.8249 L NO. OF SEEDS 65.9751 80 PERCENT OF THE TIME

41.8306 L NO. OF SEEDS 68.7674 90 PERCENT OF THE TIME

9TH FT 69 SEEDS
10TH FT 53 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
12	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.1	11	0	4.629	2.151

1. 34189 L NO. OF SEEDS 26.85811 80 PERCENT OF THE TIME

5. 60928 L NO. OF SEEDS 27.63707 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
49.2	61	32	45.289	6.73

1ST FT 53 SEEDS 3RD FT 58 SEEDS 5TH FT 48 SEEDS 7TH FT 43 SEEDS

2ND FT 41 SEEDS 4TH FT 52 SEEDS 6TH FT 32 SEEDS 8TH FT 51 SEEDS

40.5725 L NO. OF SEEDS 57.8275 80 PERCENT OF THE TIME

38.1296 L NO. OF SEEDS 60.2704 90 PERCENT OF THE TIME

9TH FT 52 SEEDS
10TH FT 50 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
13	1	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.217	8	0	2.306	1.518

2. 70051 L NO. OF SEEDS 24.16228 80 PERCENT OF THE TIME

2. 281136 L NO. OF SEEDS 24.71447 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
26.6	37	20	44.489	6.67

1ST FT 20 SEEDS 3RD FT 28 SEEDS 5TH FT 26 SEEDS 7TH FT 29 SEEDS

2ND FT 27 SEEDS 4TH FT 25 SEEDS 6TH FT 24 SEEDS 8TH FT 30 SEEDS

18.0491 L NO. OF SEEDS 35.1509 80 PERCENT OF THE TIME

15.6279 L NO. OF SEEDS 37.5721 90 PERCENT OF THE TIME

9TH FT 30 SEEDS
10TH FT 37 SEEDS

Øyjord Seeder Test Results

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
13	2	P.P.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.175	8	0	2.448	1.565

169127 L NO. OF SEEDS 24.18087 90 PERCENT OF THE TIME

398839 L NO. OF SEEDS 24.74884 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
26.1	37	15	34.767	5.896

1ST FT 29 SEEDS 3RD FT 26 SEEDS 5TH FT 21 SEEDS 7TH FT 33 SEEDS

2ND FT 15 SEEDS 4TH FT 22 SEEDS 6TH FT 24 SEEDS 8TH FT 37 SEEDS

185409 L NO. OF SEEDS 233.6591 90 PERCENT OF THE TIME

164005 L NO. OF SEEDS 235.7995 90 PERCENT OF THE TIME

9TH FT 28 SEEDS 10TH FT 26 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
14	1	D.F.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.625	9	0	4.304	2.075

965484 L NO. OF SEEDS 26.28452 90 PERCENT OF THE TIME

212439 L NO. OF SEEDS 27.03756 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
43.5	59	24	37.833	6.151

1ST FT 34 SEEDS 3RD FT 45 SEEDS 5TH FT 38 SEEDS 7TH FT 52 SEEDS

2ND FT 24 SEEDS 4TH FT 43 SEEDS 6TH FT 39 SEEDS 8TH FT 59 SEEDS

35.6146 L NO. OF SEEDS 251.3854 90 PERCENT OF THE TIME

33.3818 L NO. OF SEEDS 253.6182 90 PERCENT OF THE TIME

9TH FT 56 SEEDS 10TH FT 45 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
14	2	DF		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.817	9	0	4.168	2.042

119944 L NO. OF SEEDS 26.43389 90 PERCENT OF THE TIME

458373 L NO. OF SEEDS 27.17496 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
45.8	62	28	69.733	8.351

1ST FT 42 SEEDS 3RD FT 31 SEEDS 5TH FT 53 SEEDS 7TH FT 37 SEEDS

2ND FT 28 SEEDS 4TH FT 44 SEEDS 6TH FT 41 SEEDS 8TH FT 58 SEEDS

35.0945 L NO. OF SEEDS 256.5055 90 PERCENT OF THE TIME

32.0632 L NO. OF SEEDS 259.5368 90 PERCENT OF THE TIME

9TH FT 62 SEEDS 10TH FT 62 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
15	1	D.F.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.75	9	0	3.92	1.98

131172 L NO. OF SEEDS 26.28828 90 PERCENT OF THE TIME

492996 L NO. OF SEEDS 27.007 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
45	51	33	47.778	6.912

1ST FT 33 SEEDS 3RD FT 51 SEEDS 5TH FT 47 SEEDS 7TH FT 45 SEEDS

2ND FT 48 SEEDS 4TH FT 37 SEEDS 6TH FT 49 SEEDS 8TH FT 49 SEEDS

36.1386 L NO. OF SEEDS 253.8614 90 PERCENT OF THE TIME

33.6295 L NO. OF SEEDS 256.3705 90 PERCENT OF THE TIME

9TH FT 46 SEEDS 10TH FT 45 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
15	2	DF		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.717	9	0	3.516	1.875

13129 L NO. OF SEEDS 26.12044 90 PERCENT OF THE TIME

632265 L NO. OF SEEDS 26.80167 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
44.6	54	35	53.156	7.291

1ST FT 35 SEEDS 3RD FT 49 SEEDS 5TH FT 48 SEEDS 7TH FT 45 SEEDS

2ND FT 38 SEEDS 4TH FT 54 SEEDS 6TH FT 42 SEEDS 8TH FT 48 SEEDS

35.2532 L NO. OF SEEDS 253.7468 90 PERCENT OF THE TIME

32.6067 L NO. OF SEEDS 256.5933 90 PERCENT OF THE TIME

9TH FT 43 SEEDS 10TH FT 44 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
16	1	DF		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.3	9	0	4.01	2.00

73277 L NO. OF SEEDS 25.86723 90 PERCENT OF THE TIME

00585555 L NO. OF SEEDS 26.59414 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
39.6	53	24	22.933	4.789

1ST FT 43 SEEDS 3RD FT 45 SEEDS 5TH FT 33 SEEDS 7TH FT 31 SEEDS

2ND FT 33 SEEDS 4TH FT 35 SEEDS 6TH FT 24 SEEDS 8TH FT 53 SEEDS

33.4607 L NO. OF SEEDS 245.7393 90 PERCENT OF THE TIME

31.7223 L NO. OF SEEDS 242.4777 90 PERCENT OF THE TIME

9TH FT 49 SEEDS 10TH FT 50 SEEDS

Øyjord Seeder Test Results

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
16	2	DF		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.925	7	0	2.961	1.721

719098 LND. OF SEEDS 5.1309 80 PERCENT OF THE TIME

0944935 LND. OF SEEDS 5.7551 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
35.1	52	27	49.211	7.015

1ST FT 31 SEEDS 3RD FT 30 SEEDS 5TH FT 39 SEEDS 7TH FT 34 SEEDS
2ND FT 32 SEEDS 4TH FT 32 SEEDS 6TH FT 27 SEEDS 8TH FT 41 SEEDS

26.1067 LND. OF SEEDS 44.0973 80 PERCENT OF THE TIME

23.5602 LND. OF SEEDS 46.6398 80 PERCENT OF THE TIME

9TH FT 52 SEEDS

10TH FT 33 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
17	1	DF		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.4	12	0	3.839	1.96

888243 LND. OF SEEDS 5.91176 80 PERCENT OF THE TIME

177036 LND. OF SEEDS 6.62296 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
40.8	54	28	22.844	4.78

1ST FT 43 SEEDS 3RD FT 50 SEEDS 5TH FT 28 SEEDS 7TH FT 36 SEEDS
2ND FT 37 SEEDS 4TH FT 38 SEEDS 6TH FT 37 SEEDS 8TH FT 44 SEEDS

34.6726 LND. OF SEEDS 46.9274 80 PERCENT OF THE TIME

32.9376 LND. OF SEEDS 48.6624 80 PERCENT OF THE TIME

9TH FT 41 SEEDS

10TH FT 54 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
17	2	DF		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.415	9	0	4.322	2.079

750106 LND. OF SEEDS 6.08066 80 PERCENT OF THE TIME

0045708 LND. OF SEEDS 6.83534 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
41	58	29	48	6.93

1ST FT 29 SEEDS 3RD FT 39 SEEDS 5TH FT 39 SEEDS 7TH FT 53 SEEDS
2ND FT 40 SEEDS 4TH FT 51 SEEDS 6TH FT 45 SEEDS 8TH FT 51 SEEDS

32.118 LND. OF SEEDS 49.882 80 PERCENT OF THE TIME

29.6031 LND. OF SEEDS 52.3969 80 PERCENT OF THE TIME

9TH FT 39 SEEDS

10TH FT 58 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
18	1	D.F.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.575	11	0	4.549	2.133

840716 LND. OF SEEDS 6.30928 80 PERCENT OF THE TIME

0665001 LND. OF SEEDS 7.0835 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
42.9	55	33	51.211	7.156

1ST FT 40 SEEDS 3RD FT 41 SEEDS 5TH FT 50 SEEDS 7TH FT 55 SEEDS
2ND FT 36 SEEDS 4TH FT 35 SEEDS 6TH FT 47 SEEDS 8TH FT 42 SEEDS

33.7258 LND. OF SEEDS 52.0742 80 PERCENT OF THE TIME

31.1281 LND. OF SEEDS 54.6719 80 PERCENT OF THE TIME

9TH FT 52 SEEDS

10TH FT 33 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
18	2	D.F.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.417	9	0	3.993	1.999

854912 LND. OF SEEDS 5.97812 80 PERCENT OF THE TIME

129548 LND. OF SEEDS 6.70379 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
41	56	27	22.889	4.784

1ST FT 41 SEEDS 3RD FT 33 SEEDS 5TH FT 34 SEEDS 7TH FT 56 SEEDS
2ND FT 27 SEEDS 4TH FT 45 SEEDS 6TH FT 37 SEEDS 8TH FT 49 SEEDS

34.8666 LND. OF SEEDS 47.1334 80 PERCENT OF THE TIME

33.1299 LND. OF SEEDS 48.8701 80 PERCENT OF THE TIME

9TH FT 36 SEEDS

10TH FT 52 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
19	1	WL		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
10.233	19	2	14.449	3.801

5.36016 LND. OF SEEDS 15.1265 80 PERCENT OF THE TIME

3.98032 LND. OF SEEDS 16.4863 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
122.8	157	90	277.733	16.665

1ST FT 118 SEEDS 3RD FT 110 SEEDS 5TH FT 100 SEEDS 7TH FT 157 SEEDS
2ND FT 90 SEEDS 4TH FT 114 SEEDS 6TH FT 132 SEEDS 8TH FT 142 SEEDS

101.435 LND. OF SEEDS 144.165 80 PERCENT OF THE TIME

95.3855 LND. OF SEEDS 150.214 80 PERCENT OF THE TIME

9TH FT 140 SEEDS

10TH FT 125 SEEDS

Øyjord Seeder Test Results

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
19	2	WL		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
9.025	19	2	13.369	3.656

4.32752 L NO. OF SEEDS 13.7125 80 PERCENT OF THE TIME

3.01025 L NO. OF SEEDS 15.0392 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
108.3	145	74	86.233	9.286

1ST FT 78 SEEDS 3RD FT 96 SEEDS 5TH FT 86 SEEDS 7TH FT 145 SEEDS
2ND FT 74 SEEDS 4TH FT 103 SEEDS 6TH FT 116 SEEDS 8TH FT 135 SEEDS

96.3951 L NO. OF SEEDS 120.205 80 PERCENT OF THE TIME

93.0242 L NO. OF SEEDS 123.576 80 PERCENT OF THE TIME

9TH FT 128 SEEDS

10TH FT 122 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
20	1	WL		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
5.3	14	0	8.279	2.877

1.61127 L NO. OF SEEDS 8.98873 80 PERCENT OF THE TIME

5.66803 L NO. OF SEEDS 10.0332 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
63.6	90	32	134.489	11.597

1ST FT 32 SEEDS 3RD FT 51 SEEDS 5TH FT 56 SEEDS 7TH FT 73 SEEDS
2ND FT 58 SEEDS 4TH FT 65 SEEDS 6TH FT 90 SEEDS 8TH FT 70 SEEDS

48.2327 L NO. OF SEEDS 78.4673 80 PERCENT OF THE TIME

44.523 L NO. OF SEEDS 82.677 80 PERCENT OF THE TIME

9TH FT 79 SEEDS

10TH FT 62 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
20	2	WL		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.483	11	0	5.109	2.26

1.58563 L NO. OF SEEDS 7.38104 80 PERCENT OF THE TIME

7.65137 L NO. OF SEEDS 8.20153 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
53.8	71	31	53.289	7.3

1ST FT 31 SEEDS 3RD FT 43 SEEDS 5TH FT 44 SEEDS 7TH FT 61 SEEDS
2ND FT 45 SEEDS 4TH FT 47 SEEDS 6TH FT 65 SEEDS 8TH FT 71 SEEDS

44.4415 L NO. OF SEEDS 63.1585 80 PERCENT OF THE TIME

41.7916 L NO. OF SEEDS 65.8084 80 PERCENT OF THE TIME

9TH FT 64 SEEDS

10TH FT 67 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
21	1	WL		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.842	13	0	6.319	2.514

1.61896 L NO. OF SEEDS 8.06438 80 PERCENT OF THE TIME

7.06444 L NO. OF SEEDS 8.97689 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
58.1	70	38	62.1	7.43

1ST FT 49 SEEDS 3RD FT 41 SEEDS 5TH FT 65 SEEDS 7TH FT 65 SEEDS
2ND FT 38 SEEDS 4TH FT 63 SEEDS 6TH FT 64 SEEDS 8TH FT 63 SEEDS

47.9974 L NO. OF SEEDS 68.2026 80 PERCENT OF THE TIME

45.1368 L NO. OF SEEDS 71.0632 80 PERCENT OF THE TIME

9TH FT 70 SEEDS

10TH FT 63 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
21	2	WL		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
5.117	22	0	13.499	3.674

1.406493 L NO. OF SEEDS 9.82684 80 PERCENT OF THE TIME

9.927198 L NO. OF SEEDS 11.1605 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
61.4	110	36	74.267	8.618

1ST FT 86 SEEDS 3RD FT 40 SEEDS 5TH FT 60 SEEDS 7TH FT 49 SEEDS
2ND FT 110 SEEDS 4TH FT 51 SEEDS 6TH FT 52 SEEDS 8TH FT 36 SEEDS

50.3552 L NO. OF SEEDS 72.4448 80 PERCENT OF THE TIME

47.2337 L NO. OF SEEDS 75.5763 80 PERCENT OF THE TIME

9TH FT 59 SEEDS

10TH FT 71 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
22	1	Slash		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.883	10	0	4.793	2.189

1.07666 L NO. OF SEEDS 6.69001 80 PERCENT OF THE TIME

2.81949 L NO. OF SEEDS 7.48472 80 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
46.6	57	38	73.156	8.553

1ST FT 38 SEEDS 3RD FT 39 SEEDS 5TH FT 49 SEEDS 7TH FT 50 SEEDS
2ND FT 42 SEEDS 4TH FT 44 SEEDS 6TH FT 45 SEEDS 8TH FT 52 SEEDS

35.6349 L NO. OF SEEDS 57.5651 80 PERCENT OF THE TIME

32.5301 L NO. OF SEEDS 60.6699 80 PERCENT OF THE TIME

9TH FT 50 SEEDS

10TH FT 57 SEEDS

Øyjord Seeder Test Results

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
22	2	Slash		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.142	13	0	5.602	2.367

107465 L NO. OF SEEDS 26.17582 80 PERCENT OF THE TIME

751674 L NO. OF SEEDS 27.63501 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
37.7	52	24	46.233	6.8

1ST FT 25 SEEDS 2ND FT 38 SEEDS 3TH FT 40 SEEDS 4TH FT 43 SEEDS

5TH FT 32 SEEDS 6TH FT 36 SEEDS 7TH FT 52 SEEDS 8TH FT 42 SEEDS

28.982 L NO. OF SEEDS 46.417 80 PERCENT OF THE TIME

26.5148 L NO. OF SEEDS 48.8852 90 PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
23	1	Slash		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
4.017	11	0	5.227	2.286

1.08579 L NO. OF SEEDS 26.94255 80 PERCENT OF THE TIME

2.55904 L NO. OF SEEDS 27.7743 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
46.2	65	30	56.178	7.084

1ST FT 30 SEEDS 2ND FT 35 SEEDS 3TH FT 37 SEEDS 4TH FT 61 SEEDS

5TH FT 46 SEEDS 6TH FT 50 SEEDS 7TH FT 49 SEEDS 8TH FT 53 SEEDS

39.1182 L NO. OF SEEDS 57.2812 80 PERCENT OF THE TIME

36.5474 L NO. OF SEEDS 59.8526 90 PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
23	2	Slash		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.742	10	0	5.454	2.335

747789 L NO. OF SEEDS 26.73524 80 PERCENT OF THE TIME

6999319 L NO. OF SEEDS 27.59227 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
44.9	62	31	42.989	6.557

1ST FT 32 SEEDS 2ND FT 32 SEEDS 3TH FT 51 SEEDS 4TH FT 43 SEEDS

5TH FT 31 SEEDS 6TH FT 41 SEEDS 7TH FT 53 SEEDS 8TH FT 46 SEEDS

36.4945 L NO. OF SEEDS 57.3055 80 PERCENT OF THE TIME

34.1144 L NO. OF SEEDS 58.6856 90 PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
24	1	Slash		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.567	12	0	5.76	2.4

489807 L NO. OF SEEDS 26.64353 80 PERCENT OF THE TIME

38141 L NO. OF SEEDS 27.51474 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
42.8	61	21	65.733	8.08

1ST FT 21 SEEDS 2ND FT 37 SEEDS 3TH FT 54 SEEDS 4TH FT 44 SEEDS

5TH FT 25 SEEDS 6TH FT 45 SEEDS 7TH FT 47 SEEDS 8TH FT 52 SEEDS

32.406 L NO. OF SEEDS 52.194 80 PERCENT OF THE TIME

29.463 L NO. OF SEEDS 56.137 90 PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
24	2	Slash		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.2	34	0	11.741	3.427

1.19282 L NO. OF SEEDS 27.59282 80 PERCENT OF THE TIME

2.43666 L NO. OF SEEDS 28.83666 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
38.4	69	18	119.378	10.96

1ST FT 18 SEEDS 2ND FT 33 SEEDS 3TH FT 69 SEEDS 4TH FT 35 SEEDS

5TH FT 21 SEEDS 6TH FT 44 SEEDS 7TH FT 37 SEEDS 8TH FT 47 SEEDS

24.3929 L NO. OF SEEDS 52.4071 80 PERCENT OF THE TIME

20.4267 L NO. OF SEEDS 56.3733 90 PERCENT OF THE TIME

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
25	1	Short		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.15	10	0	4.263	2.065

503042 L NO. OF SEEDS 25.79676 80 PERCENT OF THE TIME

246447 L NO. OF SEEDS 26.54645 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
37.8	55	25	64.844	8.053

1ST FT 25 SEEDS 2ND FT 33 SEEDS 3TH FT 37 SEEDS 4TH FT 25 SEEDS

5TH FT 33 SEEDS 6TH FT 37 SEEDS 7TH FT 55 SEEDS 8TH FT 38 SEEDS

27.4766 L NO. OF SEEDS 48.1224 80 PERCENT OF THE TIME

24.5535 L NO. OF SEEDS 51.0465 90 PERCENT OF THE TIME

Øyjord Seeder Test Results

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
25	2	Short		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.708	9	0	2.578	1.606

649702 L NO. OF SEEDS 4.76676 80 PERCENT OF THE TIME

0670548 L NO. OF SEEDS 5.34961 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
32.5	44	22	47.833	6.916

1ST FT 44 SEEDS 3RD FT 28 SEEDS 5TH FT 32 SEEDS 7TH FT 22 SEEDS

2ND FT 29 SEEDS 4TH FT 41 SEEDS 6TH FT 32 SEEDS 8TH FT 37 SEEDS

23.6335 L NO. OF SEEDS 41.365 80 PERCENT OF THE TIME

21.229 L NO. OF SEEDS 43.8771 90 PERCENT OF THE TIME

9TH FT 27 SEEDS

10TH FT 33 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
26	1	Short		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
3.292	9	0	4.914	2.217

449725 L NO. OF SEEDS 6.13361 80 PERCENT OF THE TIME

3.54774 L NO. OF SEEDS 6.93831 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
39.5	59	23	47.167	6.868

1ST FT 45 SEEDS 3RD FT 36 SEEDS 5TH FT 42 SEEDS 7TH FT 49 SEEDS

2ND FT 23 SEEDS 4TH FT 32 SEEDS 6TH FT 36 SEEDS 8TH FT 33 SEEDS

30.6955 L NO. OF SEEDS 48.3045 80 PERCENT OF THE TIME

28.2025 L NO. OF SEEDS 50.7975 90 PERCENT OF THE TIME

9TH FT 40 SEEDS

10TH FT 59 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
27	1	Short Leaf		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.45	9	0	2.122	1.709

2.58624 L NO. OF SEEDS 4.6438 80 PERCENT OF THE TIME

3.61867 L NO. OF SEEDS 5.26187 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
29.4	46	13	30.489	5.520

1ST FT 13 SEEDS 3RD FT 11 SEEDS 5TH FT 27 SEEDS 7TH FT 11 SEEDS

2ND FT 28 SEEDS 4TH FT 28 SEEDS 6TH FT 16 SEEDS 8TH FT 11 SEEDS

22.3212 L NO. OF SEEDS 23.6488 80 PERCENT OF THE TIME

20.3168 L NO. OF SEEDS 28.4832 90 PERCENT OF THE TIME

9TH FT 25 SEEDS

10TH FT 26 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
27	2	Short Leaf		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.108	7	0	2.45	1.565

101543 L NO. OF SEEDS 4.11512 80 PERCENT OF THE TIME

4.66683 L NO. OF SEEDS 4.68335 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
25.3	38	14	41.784	6.474

1ST FT 14 SEEDS 3RD FT 27 SEEDS 5TH FT 19 SEEDS 7TH FT 24 SEEDS

2ND FT 27 SEEDS 4TH FT 21 SEEDS 6TH FT 29 SEEDS 8TH FT 29 SEEDS

17.0126 L NO. OF SEEDS 23.5874 80 PERCENT OF THE TIME

14.666 L NO. OF SEEDS 25.933 90 PERCENT OF THE TIME

9TH FT 25 SEEDS

10TH FT 18 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
26	2	Short		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
2.317	9	0	2.79	1.67

175444 L NO. OF SEEDS 4.45789 80 PERCENT OF THE TIME

4.30846 L NO. OF SEEDS 5.86418 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
27.8	43	14	9.956	3.155

1ST FT 43 SEEDS 3RD FT 19 SEEDS 5TH FT 22 SEEDS 7TH FT 35 SEEDS

2ND FT 14 SEEDS 4TH FT 29 SEEDS 6TH FT 27 SEEDS 8TH FT 24 SEEDS

23.755 L NO. OF SEEDS 31.845 80 PERCENT OF THE TIME

22.6096 L NO. OF SEEDS 32.9904 90 PERCENT OF THE TIME

9TH FT 32 SEEDS

10TH FT 33 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
28	1	Gr. Flat		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
6.867	14	2	6.957	2.638

3.48528 L NO. OF SEEDS 10.2481 80 PERCENT OF THE TIME

2.52784 L NO. OF SEEDS 11.2055 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
82.4	97	66	105.156	10.255

1ST FT 66 SEEDS 3RD FT 77 SEEDS 5TH FT 76 SEEDS 7TH FT 97 SEEDS

2ND FT 76 SEEDS 4TH FT 69 SEEDS 6TH FT 94 SEEDS 8TH FT 97 SEEDS

69.2537 L NO. OF SEEDS 75.5463 80 PERCENT OF THE TIME

65.5213 L NO. OF SEEDS 79.2627 90 PERCENT OF THE TIME

9TH FT 86 SEEDS

10TH FT 86 SEEDS

Øyjord Seeder Test Results

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
28	2	Gt. Fir.		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
6.858	18	1	9.618	3.101

2.88239 L NO. OF SEEDS 110.8343 80 PERCENT OF THE TIME

1.7566 L NO. OF SEEDS 111.9601 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
82.3	111	61	135.344	11.634

1ST FT 88 SEEDS 3RD FT 63 SEEDS 5TH FT 71 SEEDS 7TH FT 1 SEEDS

2ND FT 61 SEEDS 4TH FT 71 SEEDS 6TH FT 102 SEEDS 8TH FT 92 SEEDS

67.3855 L NO. OF SEEDS 97.2145 80 PERCENT OF THE TIME

9TH FT 73 SEEDS

63.1625 L NO. OF SEEDS 101.438 90 PERCENT OF THE TIME

10TH FT 79 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
29	1	GF		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
7.092	14	0	9.664	3.109

3.10636 L NO. OF SEEDS 111.077 80 PERCENT OF THE TIME

1.97791 L NO. OF SEEDS 112.2054 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
85.1	110	63	358.544	18.935

1ST FT 63 SEEDS 3RD FT 76 SEEDS 5TH FT 89 SEEDS 7TH FT 110 SEEDS

2ND FT 86 SEEDS 4TH FT 79 SEEDS 6TH FT 96 SEEDS 8TH FT 92 SEEDS

60.825 L NO. OF SEEDS 110.375 80 PERCENT OF THE TIME

9TH FT 89 SEEDS

53.9515 L NO. OF SEEDS 116.249 90 PERCENT OF THE TIME

10TH FT 73 SEEDS

TEST NUMBER	ROW NUMBER	SPECIES	HOPPER	SPINNER
29	2	GF		

SEEDS PER INCH

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
6.75	15	0	8.155	2.856

3.08889 L NO. OF SEEDS 110.411 80 PERCENT OF THE TIME

2.05225 L NO. OF SEEDS 111.4478 90 PERCENT OF THE TIME

SEEDS PER FOOT

AVERAGE	MAXIMUM	MINIMUM	VARIANCE	STD. DEV.
81	101	58	91.556	9.568

1ST FT 58 SEEDS 3RD FT 80 SEEDS 5TH FT 81 SEEDS 7TH FT 87 SEEDS

2ND FT 83 SEEDS 4TH FT 76 SEEDS 6TH FT 101 SEEDS 8TH FT 79 SEEDS

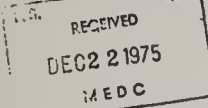
68.7332 L NO. OF SEEDS 93.2668 80 PERCENT OF THE TIME

9TH FT 77 SEEDS

65.2599 L NO. OF SEEDS 96.7401 90 PERCENT OF THE TIME

10TH FT 88 SEEDS

EVALUATION OF ØYJORD SEEDER

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICELucky Peak Nursery
C/o Idaho City Stage
Boise, Idaho 83703

December 18, 1975



Tree Seed Drills

Jim Lott Project Leader, Missoula Equipment Development Center

The tree seed drill testing that has been accomplished to date really brings us to two (2) seed drills that show any promise for future testing, the Wind River and Øyrd. The Ventura and the Dahlman have gone by because of poor design resulting in uneven, poor distribution flow and damage to the seed. The Stan Hay, as described by you, is complicated to operate, has a high initial purchase price and has exorbitant maintenance costs.

To date then, we have the Wind River (Coeur d' Alene-Lucky Peak conversion) and the Øyrd. The Wind River we jointly tested in June and found that it would throw good distribution and counts over 10 feet, but the counts for each individual foot within the 10 feet varied greatly.

The Wind River is a good tree seed drill and has been maintenance free. The original cost was \$871.38 in January 1960 and it would be next to impossible to obtain replacement parts or build a new similar drill from scratch. During the week of November 18-20 when we were jointly testing the Øyrd, we at Lucky Peak were extremely impressed with the ease of operation, its calibration was simple and quick, and the drill was the best I have worked with in handling small seed lots that cover 5 to 20 lineal feet of bed space.

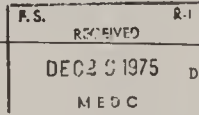
I would encourage more work on seed counts and distribution. I also suggest revisions in the bed former and trenching for the seed fall area before testing further at Cd'A or Lucky Peak, as both nurseries cover the seed with sand.

We are proud to be a part of the tree seed drill testing project and the exposure to other machines has made us appreciate the work that goes into such an undertaking.

Keep up the good work and let us know if we can be of assistance during the winter, before you return for next springs sowing tests.

Frank E. Morby
NURSEYMAN

wls

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
INT-Boise

December 19, 1975

REPLY TO: 1631

SUBJECT: Norweigen Drill

TO: Richard Hallman, Missoula Equip. Develop. Center



Attached is a list of the shrubs and forbs we planted this fall at the Lucky Peak Nursery using the Norweigen Drill. I have also mailed a number of seed samples of the various species which we planted.

The drill performed very well and I was impressed with the seeding mechanism, and the uniform seeding rates that can be achieved with this machine. With minor adjustments, the seeding rates of nearly all seeded shrubs and forbs was easily regulated.

The only problems we encountered occurred when trashy samples of big sagebrush, rubber rabbitbrush, Western virginianbawer, and fourwing saltbrush were planted. These seeds have long winged appendages or tails which stick together to form a mass of material. This prevents the seeds from moving uniformly through the machine. However, most seeds of this type could be processed through a small chopper or hammer mill to break up the inert materials and somewhat reduce this problem.

It is obvious the machine will not handle seed lots that contain small sticks or extraneous materials that are 3/4 inch or longer in length. Materials of this type catch or plug in the planting tubes. However, the machine was able to plant long seeds including curleaf Mtn. mahogany and large size seeds such as chokecherry. Seeds that were larger than 1/2 inch in diameter or one inch in length could not be planted.

The seeded hopper and the mechanism which regulates seeding rates operates very well and possesses a number of unique features, which could be incorporated in other seeders. The following features were of special interest:

1. The regulating unit which controls the seeding rates can handle a wide assortment of seeds with various sizes and shapes. With some modifications, the seed tubes and openings could handle larger size seeds.
2. The seed hopper or turret which dispenses the seed is a simple device, which could be used on other seeders particularly in regulating the planting of seed mixtures.
3. The planting unit can easily control seeding rates, even when mixtures are planted. Although other seeders have regulating devices, the operation of this drill appears to function much better than the other machines I have observed.

4. Small test plots can be planted with this machine. We were able to seed approximately 100 separate seed sources in plots ranging in length from 10' to 20' in about 2 hours. This same planting would have required about 3-5 man days if hand planted.

With very little experience we were able to regulate the machine to plant the precise footage and amount of seed desired. Also, the seeder does not require cleaning and disassembly to remove seeds that may be trapped in the machine. This is frequently a problem with other machines particularly when small samples are planted and through mixing, individual samples could be contaminated. The seeder is self cleaning and any seed trapped in the seed hopper is detectable and easily removed.

Although we had little time to inspect the drill, the unit appears to function properly and seemed to be structurally sound.

If possible, it would be helpful if further field tests could be conducted using other seed samples. We will be making field counts to determine plant establishment, frequency or distribution and density of each seeded plot. If useful, I will certainly send you copies of this information.

If available, I would appreciate receiving any information you have of this machine.

Sincerely,

STEPHEN B. MONSEN
Botanist

SPECIES PLANTED AT THE LUCKY PEAK NURSERY
Nov. 13-14, 1975

Symbol	Scientific Name	Common Name	% Purity	% Germ	Length Planting Bed (Ft)	Grams Seed Planted
Shrubs						
ACGL ² B2-73	Acer glabrum douglasii	Douglas Rocky Mtn. Maple			10.8"	140
ACGL ² B3-74	" " "	" " " "			10.0"	90
ACGL ² B6-74	" " "	" " " "			9.7"	94
ACMIL B2-73	Achillea millefolium lanolosa	Western yarrow			18.8"	30
ALOC B1-73	Allenrolfea occidentalis	Iodine brush			9.8"	90
AMAL B6-67	Amelanchier alnifolia	Saskatoon serviceberry			9.6"	74
AMAL B9-72	" " "	" " "			9.7"	
AMAL B10-74	" " "	" " "			14.8"	125
AMFR B1-74	Amorpha fruticosa	Indigobush amorpha			14.5"	75
AMUT B2-67	" " "	" " "			7.4"	130
*ARTR B3-59	Artemisia tridentata	Big Sagebrush			10.4"	50
ARTR Ada-El-more Co.	Artemisia tridentata	Big Sagebrush			21.8"	30
ARTRW B1-74	Artemisia tridentata Wyomingensis	Big Sagebrush			10.4"	130
ARUV B5-74	Arctostaphylos Uva-ursi	Bearberry			16.4"	80
ARUV B3-74	" " "	" " "			10.8"	100
ATCA B30-70	Atriplex canescens	Fourwing saltbush			16.3"	32
ATCA B3-70	" " "	" " "			13.4"	47
ATCA R10-67	" " "	" " "			20.9"	80
ATCA B32-69	" " "	" " "			20.0"	85
ATCA B31-73	" " "	" " "			4.9"	80
ATCA B4-69	" " "	" " "			5.6"	80
ATCA Bliss, Idaho	" " "	" " "			15.7"	82
ATCA B28-73	" " "	" " "			15.2"	47
ATCA B36-72	" " "	" " "			16.4"	62
ATCA B34-71	" " "	" " "			15.7"	52
ATCA B33-68	" " "	" " "			15.9"	32
ATCA B16-74	" " "	" " "			15.9"	52
ATCA B25-74	" " "	" " "			15.5"	57
ATCA B38-74	" " "	" " "			15.4"	67
ATCA B37-74	" " "	" " "			9.9"	52
ATCA B35-72	" " "	" " "			9.2"	47
ATCA B39-74	" " "	" " "			9.8"	52
ATC' B29-74	" " "	" " "			23.9"	245
ATI B13-74	" " "	" " "			19.1"	145
ATCO B9-74	Atriplex confertifolia	Shadscale SALT BUSH			15.9"	32
ATCO B7-74	" " "	" " "			11.0"	60
*ATNUG B1-74	Atriplex gardneri	Gardner Saltbush			9.3"	82
CAAL B4-74	Caragana arborescens	Siberian peashrub			10.5"	125
CAAL B2-70	" " "	" " "			10.2"	120
CEBE B1-72	Cercocarpus betuloides	Mahogany			18.4"	130
CECU B5-71	Ceanothus cuneatus	Wedgeleaf ceanothus			19.0"	220
CEIN B2-72	Ceanothus integerrimus	Deerbrush ceanothus			20.9"	125
CEIN B1-70	Ceanothus integerrimus	Deerbrush ceanothus			9.0"	92
CELE B8-74	Cercocarpus ledifolius	Curlleaf mtn. mahogany			17.3"	100
CELE B3-73	" " "	" " "			20.2"	90
CELE Redding, CALIFORNIA	" " "	" " "			20.0"	160
CEMA B1-64	Ceanothus martinii	Martin ceanothus			20.2"	95
CEPR B1-72	Ceanothus prostratus	Squawcarpet ceanothus			20.3"	135
CEPR B2-74	" " "	" " "			9.7"	105
CEPR B4-74	" " "	" " "			10.0"	140
CESA B5-74	Ceanothus sanguineus	Redstem ceanothus			16.0"	155
CEVE B7-71	Ceanothus velutinus	Snowbrush ceanothus			18.3"	90
CEVE B3-74	" " "	" " "			20.5"	80
CEVE B2-74	" " "	" " "			11.3"	70
CEVE B10-74	" " "	" " "			17.4"	65
CLLI B2-72	Clematis ligusticifolia	Western Virginsbower			19.7"	75
COMES B5-69	Cowania mexicana stanisburiana	Stansbury cliffrose			20.8"	160
COST B6-74	Coinus stolonifera stolonifera	Redosier DOGWOOD			20.3"	258
COST B5-72	" " "	" " "			10.1"	240
ELCO B1-74	Elaeagnus commutata	Silverberry			25.0"	410
EPVI B12-75	Ephedra viridis	Green ephedra			10.0"	42
EPVI B9-73	" " "	" " "			9.8"	92
EPVI B11-75	" " "	" " "			6.3"	102
EPVI B -70 (Utah)	" " "	" " "			19.8"	160
ERUM B5-74	Erigonum umbellatum	Sulfur eriogonum			19.2"	50
FAPA B1-75	Fallugia paradoxa	Apache-plume			9.6"	30
FAPA B5-74	" " "	" " "			4.9"	35
FRAN B4-69	Fraxinus anomala	Single-leaf ash			15.5"	42
JUCO B1-74	Juniperus communis	Mountain common Juniper			21.4"	65
LATA B4-71	Lonicera tatarica	Tatarian honeysuckle			20.4"	115

SPECIES PLANTED AT THE LUCKY PEAK NURSERY
NOVEMBER 13-14, 1975 (CONTINUED)

Symbol	Scientific Name	Common Name	% Purity	% Germ	Length Planting Bed (Ft)	Grams Seed Planted
*MAAQ B1-71	Mahonia aquifolium	Bear berry			21.9"	500
PERA B1-67	Peraphyllum ramosissimum	Squaw-apple			20.6"	210
*PEFRS B8-71	Penstemon fruticosus	Bush penstemon			17.1"	140
PESPP B?	Penstemon species				10.0"	20
PRAN B4-74	Prunus andersonii	Anderson peachbrush			24.2"	122
PRDE B3-74	Prunus demissa				15.2"	465
PREM B2-73	Prunus emarginata	Bittercherry			5.4"	90
PRVIM B14-74	Prunus virginiana melanocarpa	Black common chokecherry			16.0"	305
PRVIM B15-70	Prunus virginiana	Black common chokecherry			15.0"	360
PRVID B2-74	Prunus virginiana demissa	Western common chokecherry			19.3"	500
PUGL B4-69	Purshia glandulosa	Desert bitterbrush			9.8"	52
PUGL B -62	" "	" "			12.0"	42
PUTR B32-72	Purshia tridentata	Antelope bitterbrush			20.1"	290
PUTR B35-74	" "	" "			20.2"	200
PUTR Willow Cr, ID	" "	" "			20.4"	250
PUTR B37-74	" "	" "			9.9"	37
PUTR B4-67	" "	" "			19.7"	62
PUTR B19-70	" "	" "			20.5"	170
PUTR Reynolds Cr, ID	" "	" "			20.3"	250
RHGIC B1-68	Rhus glabra cismontana	Rocky Mountain smooth sumac			19.6"	125
RHTRT B1-67	Rhus trilobata trilobata	Skunkbrush sumac			22.3"	195
RHTRT B7-74	" " "	" "			20.1"	210
RIAU B6-69	Ribes aureum	Golden currant			20.5"	40
RIAU B7-69	" "	" "			19.5"	50
ROPR Judith Basin, ROSA spp. Montana					16.1"	160
ROWO B16-73	Rosa woodsii ultramontana	Woods Rose			12.8"	44
ROWO B18-74	" " "	" "			19.6"	135
ROWO B15-73	" " "	" "			20.0"	190
SACE B18-74	Sambucus cerulea	Blueberry elder			19.6"	137
SACE B19-74	" "	" "			19.7"	80
SACE Banks	" "	" "			20.8"	128
SHAR B4-74	Shepherdia argentea	Silver buffaloberry			21.0"	100
SOSC B6-74	Sorbus scopulina	Greenes mountain ash			20.9"	92
SOSC B8-74	" "	" "			20.2"	110
SYALP B2-74	Symphoricarpos albus pauciflorus	Dwarf common snowberry			20.2"	102
SYOC B1-75	Symphoricarpos occidentalis	Western snowberry			20.1"	152
SYOR B11-73	Symphoricarpos oreophilus utahensis	UTAH "			20.0"	142
Forbs						
ASCI B8-65	Astragalus ^{CICER} fibrius	Cicer milkvetch			20.4"	65
ASFA B3-68	Astragalus falcatus	Sicklepod milkvetch			20.8"	60
ASGA B3-73	Astragalus galegiformis				19.1"	180
CORVA B1-68	Coronilla varia	Crownvetch coronilla			20.9"	120
LILE B3-74	Linum lewisii	Lewis flax			19.5"	30
POGIG B1-74	Potentilla glandulosa glandulosa	Gland cinquefoil			19.2"	25

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